Soil adsorbing agent-containing articles of manufacture that provide superior mirror cleaning properties compared to known soil adsorbing agent-containing articles of manufacture, are provided.
<table>
<thead>
<tr>
<th>Side 3 - Wet Side to Side</th>
<th>Side 1 - Wet Side to Side</th>
<th>Side 5 - Wet Side to Side</th>
<th>Side 7 - Wet Side to Side</th>
</tr>
</thead>
<tbody>
<tr>
<td>Side 4 - Dry Up and Down</td>
<td>Side 2 - Dry Up and Down</td>
<td>Side 6 - Dry Up and Down</td>
<td>Side 8 - Dry Up and Down</td>
</tr>
</tbody>
</table>

**FIG. 1**

<p>| | | |</p>
<table>
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**FIG. 2**
ARTICLES OF MANUFACTURE AND METHODS FOR MAKING SAME

FIELD OF THE INVENTION

[0001] The present invention relates to articles of manufacture, more particularly to soil adsorbing agent-containing articles of manufacture, such as dry fibrous structures that provide superior mirror cleaning properties compared to known soil adsorbing agent-containing articles of manufacture.

BACKGROUND OF THE INVENTION

[0002] In the past, fibrous structures, such as paper towels, have been commonly utilized in combination with liquid cleaning compositions to clean windows, mirrors, countertops, and other hard surfaces. Known paper towels typically provide cleaning performance primarily by absorption of soil laden fluid into the pores of the paper towel; consequently, the cleaning performance of known paper towels is limited by the ability and capacity of the paper towels to absorb and retain the soil laden fluid.

[0003] Articles of manufacture, such as fibrous structures, for example paper towels that comprise 6 #ton to more of a soil adsorbing agent are known to exhibit a Mirror 2 Densitometer Value greater than its Mirror 1 Densitometer Value as measured according to the Mirror Cleaning Test Method described herein.

[0004] Further, articles of manufacture, such as fibrous structures, for example paper towels that comprise less than 6 #ton of a soil adsorbing agent are known to exhibit a Mirror 2 Densitometer Value greater than its Mirror 1 Densitometer Value as measured according to the Mirror Cleaning Test Method described herein and a difference between the Mirror 2 Densitometer Value and the Mirror 1 Densitometer of 0.21 or less.

[0005] Further, articles of manufacture, such as fibrous structures, for example paper towels that comprise less than 6 #ton of a soil adsorbing agent are known to exhibit a Mirror 2 Densitometer Value greater than its Mirror 1 Densitometer Value as measured according to the Mirror Cleaning Test Method described herein and a sum of the Mirror 2 Densitometer Value and the Mirror 1 Densitometer Value of 0.48 or less as measured according to the Mirror Cleaning Test Method.

[0006] The prior art articles of manufacture described above still do not meet consumers’ desires for improved mirror cleaning on at least the first and second mirrors as measured according to the Mirror Cleaning Test Method described herein.

[0007] In light of the foregoing, it is clear that there is a need for an article of manufacture, such as a fibrous structure, more particularly a dry fibrous structure, such as a paper towel that exhibits improved mirror cleaning properties compared to known articles of manufacture.

SUMMARY OF THE INVENTION

[0008] The present invention fulfills the needs described above by providing an article of manufacture, such as a fibrous structure, for example a dry paper towel that exhibits improved cleaning of various hard surfaces including mirrors, compared to known articles of manufacture.

[0009] In one example of the present invention, an article of manufacture comprising greater than 0 #ton to less than 6 #ton of a soil adsorbing agent, wherein the article of manufacture exhibits a Mirror 2 Densitometer Value greater than the Mirror 1 Densitometer Value as measured according to the Mirror Cleaning Test Method and wherein the difference between the Mirror 2 Densitometer Value and the Mirror 1 Densitometer is greater than 0.20 and wherein the article of manufacture exhibits a sum of the Mirror 2 Densitometer Value and the Mirror 1 Densitometer Value of greater than 0.48 as measured according to the Mirror Cleaning Test Method, is provided.

[0010] In another example of the present invention, an article of manufacture, for example a fibrous structure, such as a dry fibrous structure comprising greater than 0 #ton to less than 6 #ton of a soil adsorbing agent, wherein the article of manufacture exhibits a Mirror 1 Densitometer Value of greater than 0.25 and wherein the article of manufacture exhibits a Mirror 2 Densitometer Value that is greater than the Mirror 1 Densitometer Value as measured according to the Mirror Cleaning Test Method, is provided.

[0011] In another example of the present invention, an article of manufacture, for example a fibrous structure, such as a dry fibrous structure comprising greater than 0 #ton to less than 6 #ton of a soil adsorbing agent, wherein the article of manufacture exhibits a VOC of less than 20%, wherein the article of manufacture exhibits a Mirror 2 Densitometer Value that is greater than the Mirror 1 Densitometer Value as measured according to the Mirror Cleaning Test Method, is provided.

[0012] In still another example of the present invention, an article of manufacture, for example a fibrous structure, such as a dry fibrous structure comprising a soil adsorbing agent that exhibits a Total Volatilites content of less than 55% and/or less than 50% and/or less than 45% and/or less than 40% and/or less than 35% and/or less than 25% and/or less than 15% as measured according to the VOC Test Method described herein, is provided.

[0013] In even another example of the present invention, an article of manufacture, for example a fibrous structure, such as a dry fibrous structure comprising a soil adsorbing agent that exhibits a Moisture content of less than 30% and/or less than 25% and/or less than 20% and/or less than 15% and/or less than 10% and/or less than 5% as measured according to the VOC Test Method described herein, is provided.

[0014] In still another example of the present invention, a method for making an article of manufacture, for example a fibrous structure, such as a dry fibrous structure comprising a soil adsorbing agent that exhibits a Volatile Organic Carbon content of less than 20% and/or less than 17% and/or less than 15% and/or less than 10% and/or less than 5% as measured according to the VOC Test Method described herein, the method comprising the step of contacting an article of manufacture with a soil adsorbing agent that exhibits a Volatile Organic Carbon content of less than 20% and/or less than 17% and/or less than 15% and/or less than 10% and/or less than 5% as measured according to the VOC Test Method described herein, is provided.

[0015] In still another example of the present invention, a method for making an article of manufacture, for example a fibrous structure, such as a dry fibrous structure comprising a soil adsorbing agent that exhibits a Total Volatilites content of less than 55% and/or less than 50% and/or less than 45% and/or less than 40% and/or less than 35% and/or less than 25% and/or less than 15% as measured according to the VOC Test Method described herein, the method comprises the step of contacting an article of manu-
facture with less than 5 #/ton of a soil adsorbing agent that exhibits a Total Volatiles content of less than 55% and/or less than 50% and/or less than 45% and/or less 40% and/or less than 35% and/or less than 25% and/or less than 15% as measured according to the VOC Test Method described herein, is provided.

[0016] In still another example of the present invention, a method for making an article of manufacture, for example a fibrous structure, such as a dry fibrous structure comprising a soil adsorbing agent that exhibits a Moisture content of less than 30% and/or less than 25% and/or less than 20% and/or less than 15% as measured according to the VOC Test Method described herein, the method comprising the step of contacting an article of manufacture with a soil adsorbing agent that exhibits a Moisture content of less than 30% and/or less than 25% and/or less than 20% and/or less than 15% as measured according to the VOC Test Method described herein, is provided.

[0017] In still yet another example of the present invention, a soil adsorbing agent composition comprising a first soil adsorbing agent that exhibits a VOC content of greater than 20% and a second soil adsorbing agent that exhibits a VOC of less than 20% as measured according to the VOC Test Method, is provided.

[0018] In even still yet another example of the present invention, an article of manufacture, for example a fibrous structure, such as a dry fibrous structure comprising a soil adsorbing agent composition according to the present invention, is provided.

[0019] Accordingly, the present invention provides articles of manufacture that exhibit improved and/or superior mirror cleaning properties based on their Mirror Densitometer Values compared to known articles of manufacture and methods for making such articles of manufacture.

BRIEF DESCRIPTION OF THE DRAWINGS

[0020] FIG. 1 is a schematic representation of a sample of article of manufacture used in the Mirror Cleaning Test Method described herein;

[0021] FIG. 2 is a schematic representation of 9 individual spectrodensitometer measurement spots on a surface of a mirror for the Mirror Cleaning Test Method described herein;

[0022] FIGS. 3 and 3A is a diagram of a support rack utilized in the VFS Test Method described herein; and

[0023] FIGS. 4 and 4A is a diagram of a support rack cover utilized in the VFS Test Method described herein.

DETAILED DESCRIPTION OF THE INVENTION

Definitions

[0024] “Article of manufacture” as used herein means any solid matter, such as a web, foam structure, or particle.

[0025] “Web” as used herein means a fibrous structure or a film.

[0026] “Fibrous structure” as used herein means a structure that comprises one or more fibrous filaments and/or fibers. In one example, a fibrous structure according to the present invention means an orderly arrangement of filaments and/or fibers within a structure in order to perform a function. Non-limiting examples of fibrous structures of the present invention include paper, fabrics (including woven, knitted, and non-woven), and absorbent pads (for example for diapers or feminine hygiene products).

[0027] Non-limiting examples of processes for making fibrous structures include known wet-laid processes, such as wet-laid papermaking processes, and air-laid processes, such as air-laid papermaking processes. Wet-laid and/or air-laid papermaking processes and/or air-laid papermaking processes typically include a step of preparing a composition comprising a plurality of fibers that are suspended in a medium, either wet, more specifically aqueous medium, or dry, more specifically gaseous medium, such as air. The aqueous medium used for wet-laid processes is oftentimes referred to as a fiber slurry. The fiber composition is then used to deposit a plurality of fibers onto a forming wire or belt such that an embryonic fibrous structure is formed, after which drying and/or bonding the fibers together results in a fibrous structure. Further processing the fibrous structure may be carried out such that a finished fibrous structure is formed. For example, in typical papermaking processes, the finished fibrous structure is the fibrous structure that is wound on the reel at the end of papermaking, and may subsequently be converted into a finished product, e.g. a sanitary tissue product.

[0028] Another process that can be used to produce the fibrous structures is a melt-blowing and/or spunbarding process where a polymer composition is spun into filaments and collected on a belt to produce a fibrous structure. In one example, a plurality of fibers may be mixed with the filaments prior to collecting on the belt and/or a plurality of fibers may be deposited on a prior produced fibrous structure comprising filaments.

[0029] The fibrous structures of the present invention may be homogeneous or may be layered in the direction normal to the machine direction. If layered, the fibrous structures may comprise at least two and/or at least three and/or at least four and/or at least five layers.

[0030] The fibrous structures of the present invention may be co-formed fibrous structures. “Co-formed” as used herein means that the fibrous structure comprises a mixture of at least two different components wherein at least one of the components comprises a filament, such as a polypropylene filament, and at least one other component, different from the first component, comprises a solid additive, such as a fiber and/or a particulate. In one example, a co-formed fibrous structure comprises solid additives, such as fibers, such as wood pulp fibers and/or absorbent gel articles of manufacture and/or filler particles and/or particulate spot bonding powders and/or clays, and filaments, such as polypropylene filaments.

[0031] “Solid additive” as used herein means a fiber and/or a particulate.

[0032] “Particulate” as used herein means a granular substance or powder.

[0033] “Fiber” and/or “Filament” as used herein means an elongate particulate having an apparent length greatly exceeding its apparent width, i.e., a length to diameter ratio of at least about 10. In one example, a “fiber” is an elongate particulate as described above that exhibits a length of less than 5.08 cm (2 in.) and a “filament” is an elongate particulate as described above that exhibits a length of greater than or equal to 5.08 cm (2 in.).

[0034] Fibers are typically considered discontinuous in nature. Non-limiting examples of fibers include wood pulp fibers and synthetic staple fibers such as polyester fibers.

[0035] Filaments are typically considered continuous or substantially continuous in nature. Filaments are relatively longer than fibers. Non-limiting examples of filaments
include meltblown and/or spunbond filaments. Non-limiting examples of articles of manufacture that can be spun into filaments include natural polymers, such as starch, starch derivatives, cellulose and cellulose derivatives, hemicellulose, hemicellulose derivatives, and synthetic polymers including, but not limited to polyvinyl alcohol filaments and/or polyvinyl alcohol derivative filaments, and thermoplastic polymer filaments, such as polyesters, nylon, polyolefins such as polypropylene filaments, polyethylene filaments, and biodegradable or compostable thermoplastic fibers such as polyactic acid filaments, polyhydroxyalkanoate filaments and polycaprolactone filaments. The filaments may be monocomponent or multicomponent, such as bicomponent filaments.

In one example of the present invention, “fiber” refers to papermaking fibers. Papermaking fibers useful in the present invention include cellulosic fibers commonly known as wood pulp fibers. Applicable wood pulps include chemical pulps, such as Kraft, sulfite, and sulfate pulps, as well as mechanical pulps including, for example, groundwood, thermomechanical pulp and chemically modified thermomechanical pulp. Chemical pulps, however, may be preferred since they impart a superior tactile sense of softness to tissue sheets made therefrom. Pulps derived from both deciduous trees (hereinafter, also referred to as “hardwood”) and coniferous trees (hereinafter, also referred to as “softwood”) may be utilized. The hardwood and softwood fibers can be blended, or alternatively, can be deposited in layers to provide a stratified web. Also applicable to the present invention are fibers derived from recycled paper, which may contain any or all of the above categories as well as other non-fibrous articles of manufacture such as fillers and adhesives used to facilitate the original papermaking.

In addition to the various wood pulp fibers, othercellulosic fibers such as cotton linters, rayon, lyocell and bagasse can be used in this invention. Other sources of cellulose in the form of fibers or capable of being spun into fibers include grasses and grain sources.

“Dry article of manufacture” as used herein means an article of manufacture that comprises less than 30% and/or less than 20% and/or less than 15% and/or less than 10% and/or less than 7% and/or less than 5% and/or less than 3% and/or less than 2% and/or less than 1% and/or less than 0.5% by weight of moisture as measured according to the Moisture Content Test Method described herein.

“Dry web” as used herein means a web that comprises less than 30% and/or less than 20% and/or less than 15% and/or less than 10% and/or less than 7% and/or less than 5% and/or less than 3% and/or less than 2% and/or less than 1% and/or less than 0.5% by weight of moisture as measured according to the Moisture Content Test Method described herein.

“Dry fibrous structure” as used herein means a fibrous structure that comprises less than 30% and/or less than 20% and/or less than 15% and/or less than 10% and/or less than 7% and/or less than 5% and/or less than 3% and/or less than 2% and/or less than 1% and/or less than 0.5% by weight of moisture as measured according to the Moisture Content Test Method described herein.

“Sanitary tissue product” as used herein means a soft, low density (i.e., <about 0.15 g/cm³) web useful as a wiping implement for post-urinary and post-bowel movement cleaning (toilet tissue), for otolaryngological discharges (facial tissue), multi-functional absorbent and cleaning uses (absorbent towels), and folded sanitary tissue products such as napkins and/or facial tissues including folded sanitary tissue products dispensed from a container, such as a box. The sanitary tissue product may be convoluted wound upon itself about a core or without a core to form a sanitary tissue product roll.

In one example, the sanitary tissue product of the present invention comprises a fibrous structure according to the present invention.

The sanitary tissue products of the present invention may exhibit a basis weight between about 10 g/m² and/or from about 15 g/m² and/or from about 20 g/m² and/or from about 30 g/m² to about 100 g/m² and/or from about 100 g/m² and/or from about 200 g/m² to about 90 g/m². In addition, the sanitary tissue product of the present invention may exhibit a basis weight between about 40 g/m² to about 120 g/m² and/or from about 50 g/m² to about 110 g/m² and/or from about 55 g/m² to about 105 g/m² and/or from about 60 to 100 g/m².

The sanitary tissue products of the present invention may exhibit a dry tensile strength of at least 59 g/cm (150 g/in) and/or from about 78 g/cm (200 g/in) to about 394 g/cm (1000 g/in) and/or from about 98 g/cm (250 g/in) to about 335 g/cm (850 g/in). In addition, the sanitary tissue product of the present invention may exhibit a total dry tensile strength at least 196 g/cm (500 g/in) and/or from about 196 g/cm (500 g/in) to about 394 g/cm (1000 g/in) and/or from about 216 g/cm (550 g/in) to about 335 g/cm (850 g/in) and/or from about 236 g/cm (600 g/in) to about 315 g/cm (800 g/in). In one example, the sanitary tissue product exhibits a total dry tensile strength of less than about 394 g/cm (1000 g/in) and/or from about 335 g/cm (850 g/in). In another example, the sanitary tissue products of the present invention may exhibit a total dry tensile strength at least 196 g/cm (500 g/in) and/or at least 236 g/cm (600 g/in) and/or at least 276 g/cm (700 g/in) and/or at least 315 g/cm (800 g/in) and/or at least 354 g/cm (900 g/in) and/or at least 394 g/cm (1000 g/in) and/or from about 354 g/cm (900 g/in) to about 1181 g/cm (3000 g/in) and/or from about 354 g/cm (900 g/in) to about 984 g/cm (2500 g/in) and/or from about 394 g/cm (1000 g/in) to about 787 g/cm (2000 g/in).

The sanitary tissue products of the present invention may exhibit an initial total wet tensile strength of at least 118 g/cm (300 g/in) and/or at least 157 g/cm (400 g/in) and/or at least 196 g/cm (500 g/in) and/or at least 236 g/cm (600 g/in) and/or at least 276 g/cm (700 g/in) and/or at least 315 g/cm (800 g/in) and/or at least 354 g/cm (900 g/in) and/or at least 394 g/cm (1000 g/in) and/or from about 118 g/cm (300 g/in) to about 1968 g/cm (5000 g/in) and/or from about 118 g/cm (300 g/in) to about 157 g/cm (400 g/in) to about 1181 g/cm (3000 g/in) and/or from about 196 g/cm (500 g/in) to about 984 g/cm (2500 g/in) and/or from about 196 g/cm (500 g/in) to about 878 g/cm (2000 g/in) and/or from about 196 g/cm (500 g/in) to about 591 g/cm (1500 g/in).

In another example, the sanitary tissue products of the present invention may exhibit an initial total wet tensile strength of less than about 78 g/cm (200 g/in) and/or less than about 59 g/cm (150 g/in) and/or less than about 59 g/cm (100 g/in) and/or less than about 29 g/cm (75 g/in).

The sanitary tissue products of the present invention may exhibit a density (measured at 95 g/in³) of less than about 0.60 g/cm³ and/or less than about 0.30 g/cm³ and/or less than about 0.20 g/cm³ and/or less than about 0.10 g/cm³ and/or less than about 0.07 g/cm³ and/or less than about 0.05 g/cm³.
and/or from about 0.01 g/cm³ to about 0.20 g/cm³ and/or from about 0.02 g/cm³ to about 0.10 g/cm³.

0048. The sanitary tissue products of the present invention may be in the form of sanitary tissue product rolls. Such sanitary tissue product rolls may comprise a plurality of connected, but perforated sheets of fibrous structure, that are separably dispensable from adjacent sheets. In one example, one or more ends of the roll of sanitary tissue product may comprise an adhesive and/or dry strength agent to mitigate the loss of fibers, especially wood pulp fibers from the ends of the roll of sanitary tissue product.

0049. The sanitary tissue products of the present invention may comprise additives such as softening agents, temporary wet strength agents, permanent wet strength agents, bulk softening agents, lotions, silicones, wetting agents, latexes, especially surface-pattern-applied latexes, dry strength agents such as carboxymethylcellulose and starch, and other types of additives suitable for inclusion in and/or on sanitary tissue products.

0050. “Weight average molecular weight” as used herein means the weight average molecular weight \( M_w \) (in units of g/mol) as determined using gel permeation chromatography according to the protocol found in Colloids and Surfaces A. Physico Chemical & Engineering Aspects, Vol. 162, 2000, pp. 107-121.

0051. “Number average molecular weight” as used herein means the number average molecular weight \( M_n \) (in units of g/mol) as determined using gel permeation chromatography according to the protocol found in Colloids and Surfaces A. Physico Chemical & Engineering Aspects, Vol. 162, 2000, pp. 107-121.

0052. “Basis Weight” as used herein is the weight per unit area of a sample reported in lbs/3000 ft² or g/m² and is measured according to the Basis Weight Test Method described herein.

0053. “By weight of moisture” or “moisture content” means the amount of moisture present in an article of manufacture measured according to the Moisture Content Test Method described herein immediately after the article of manufacture has been conditioned in a conditioned room at a temperature of 73°F ±4°F (about 23°C ±2.2°C) and a relative humidity of 50% ±10% for 2 hours.

0054. “Water-soluble” as used herein means a material, such as a polymer, for example a soil adsorbing agent that is miscible in water. In other words, a material that is capable of forming a stable (does not separate for greater than 5 minutes after forming the homogeneous solution) homogeneous solution with water at ambient conditions.

0055. “Machine Direction” or “MD” as used herein means the direction parallel to the flow of the fibrous structure through the fibrous structure making machine and/or sanitary tissue product manufacturing equipment.

0056. “Cross Machine Direction” or “CD” as used herein means the direction parallel to the width of the fibrous structure making machine and/or sanitary tissue product manufacturing equipment and perpendicular to the machine direction.

0057. “Ply” as used herein means an individual, integral fibrous structure.

0058. “Plies” as used herein means two or more individual, integral fibrous structures disposed in a substantially contiguous, face-to-face relationship with one another, forming a multi-ply fibrous structure and/or multi-ply sanitary tissue product. It is also contemplated that an individual, integral fibrous structure can effectively form a multi-ply fibrous structure, for example, by being folded on itself.

Article of Manufacture

0059. A non-limiting example of an article of manufacture of the present invention includes a dry article of manufacture, for example a dry fibrous structure such as a dry paper towel, rather than a pre-moistened, liquid composition-containing towel or wipe or pad, that exhibits improved and/or superior average Mirror Cleaning Densitometer Values and/or improved and/or superior total Mirror Cleaning Densitometer Values as measured according to the Mirror Cleaning Test Method described herein compared to known articles of manufacture.

0060. In one example, the article of manufacture exhibits a Mirror 2 Densitometer Value that is greater than its Mirror 1 Densitometer Value as measured according to the Mirror Cleaning Test Method described herein. In another example, the article of manufacture exhibits a Mirror 2 Densitometer Value that is greater than its Mirror 1 Densitometer Value and wherein the difference between the Mirror 2 Densitometer Value and Mirror 1 Densitometer Value is greater than −0.20 and/or greater than −0.18 and/or greater than −0.15 and/or greater than −0.10 and/or greater than −0.07 and/or greater than −0.05 as measured according to the Mirror Cleaning Test Method described herein.

0061. In another example, the article of manufacture exhibits a Mirror 2 Densitometer Value that is statistically equivalent to the Mirror 1 Densitometer Value.

0062. In another example, the article of manufacture exhibits a sum of the Mirror 1 and Mirror 2 Densitometer Values of −0.48 or greater and/or −0.45 or greater and/or −0.41 or greater and/or −0.39 or greater −0.35 or greater and/or −0.29 or greater and/or −0.25 or greater and/or −0.21 or greater and/or −0.10 or greater as measured according to the Mirror Cleaning Test Method described herein.

0063. In another example, the article of manufacture exhibits an Average Mirror Cleaning Densitometer Value of greater than −0.45 and/or greater than −0.38 and/or greater than −0.30 and/or greater than −0.25 and/or greater than −0.20 and/or greater than −0.15 as measured according to the Mirror Cleaning Test Method described herein.

0064. In one example, the article of manufacture exhibits a Mirror 2 Densitometer Value of greater than −0.27 and/or greater than −0.21 and/or greater than −0.17 and/or greater than −0.10 and/or greater than −0.06 as measured according to the Mirror Cleaning Test Method described herein.

0065. In one example, the article of manufacture exhibits a Mirror 1 Densitometer Value of greater than −0.30 and/or greater than −0.25 and/or greater than −0.20 and/or greater than −0.15 and/or greater than −0.10 and/or greater than −0.07 as measured according to the Mirror Cleaning Test Method described herein.

0066. In one example, the article of manufacture comprises two or more soil adsorbing agents. In another example, the article of manufacture comprises a blend (mixture) of two or more soil adsorbing agents. In another example, the two or more soil adsorbing agents are different soil adsorbing agents.

0067. In one example, the article of manufacture comprises a web. In another example, the article of manufacture comprises a particle.
[0068] When the article of manufacture comprises a web, the web may comprise a fibrous structure. The fibrous structure may be a dry fibrous structure.

[0069] The fibrous structure of the present invention may comprise a plurality of pulp fibers. Further, the fibrous structure of the present invention may comprise a single-ply or multi-ply sanitary tissue product, such as a paper towel.

[0070] In another example, the article of manufacture of the present invention may comprise a web, for example a fibrous structure, in the form of a cleaning pad suitable for use with a cleaning device, such as a floor cleaning device, for example a Swiffer® cleaning pad or equivalent cleaning pads.

[0071] In still another example, the article of manufacture of the present invention may comprise a foam structure.

[0072] The article of manufacture of the present invention may comprise a soil adsorbing agent. When present, the soil adsorbing agent may be present in and/or on the article of manufacture at a level of greater than 0.005% and/or greater than 0.01% and/or greater than 0.05% and/or greater than 0.1% and/or greater than 0.15% and/or greater than 0.2% and/or less than 5% and/or less than 3% and/or less than 2% and/or less than 1% by weight of the article of manufacture. In one example, the soil adsorbing agent is present in and/or on the article of manufacture at a level of from about 0.005% to about 1% by weight of the article of manufacture.

[0073] In another example of the present invention, an article of manufacture may comprise a soil adsorbing agent at a level of from greater than 0 pounds/ton (#/ton) and/or greater than 0.1 #/ton and/or greater than 0.5 #/ton and/or greater than 1 #/ton and/or greater than 2 #/ton and/or greater than 3 #/ton and/or to less than 20 #/ton and/or to less than 15 #/ton and/or to less than 10 #/ton and/or to less than 6 #/ton and/or to 5 #/ton or less and/or to 4 #/ton or less by weight of the article of manufacture. The level of soil adsorbing agent present in and/or on an article of manufacture as used herein according to the present invention is in terms of active solids basis of the soil adsorbing agent.

[0074] The article of manufacture may comprise other ingredients in addition to the soil adsorbing agent, for example a surfactant. The surfactant may be present in the article of manufacture at a level of from about 0.01% to about 0.5% by weight of the article of manufacture. Non-limiting examples of a suitable surfactant include C8-16 alkyl polyglycoside, cocoamido propyl sulfobetaine or mixtures thereof.

[0075] In one example, the article of manufacture comprises a signal, such as a dye and/or pigment that becomes visible or becomes invisible to a consumer’s eye when the article of manufacture adsorbs soil and/or when a soil adsorbing agent present in and/or on the article of manufacture adsorbs soil. In another example, the signal may be a difference in texture of the article of manufacture or a difference in the physical state of the article of manufacture, for example the article of manufacture dissolves and/or vaporizes when the article of manufacture adsorbs soil.

[0076] In another example, the soil adsorbing agent may be present in and/or on an article of manufacture in a pattern, such as a non-random repeating pattern composing lines and/or letters/words, and/or present in and/or on regions of different density, different basis weight, different elevation and/or different texture of the article of manufacture. In one example, the soil adsorbing agent present in and/or on an article of manufacture may provide a visual signal resulting from an increased concentration of soil adsorbed onto the soil adsorbing agent.

[0077] In still another example of the present invention, the article of manufacture may provide a residual cleaning effect as measured according to the Mirror Cleaning Test Method described herein on a surface, such as a mirror, after adsorbing at least a portion of the soil previously present on the surface. Without being bound by theory, it is believed that this residual cleaning effect, which at least partially inhibits at least some soils from collecting and/or remaining on the surface, results from at least a portion of the soil adsorbing agent depositing on the surface and remaining on the surface after cleaning with the article of manufacture.

[0078] Table 1 below shows individual Mirror Densitometer ("Density") Values and Average Mirror Cleaning Densitometer ("Density") Values for articles of manufacture, in this case dry fibrous structures (e.g., paper towels) for example a fibrous structure in accordance with the present invention and of known articles of manufacture, such as dry fibrous structures (e.g., paper towels), as measured according to the Mirror Cleaning Test Method described herein. Statistical analysis software, for example JMP Statistical Analysis software, was utilized to compare the mean Mirror Densitometer Values by mirror # for each of the articles of manufacture. Within Table 1, the letters A, B, C and D are listed along with the mean Mirror Densitometer Values for each article of manufacture and each mirror within that article of manufacture. Mirrors connected by the same letter are not significantly different at a 95% Confidence Interval utilizing a students t-test.

<table>
<thead>
<tr>
<th>Article of manufacture</th>
<th>Mirror 1 Densitometer Value</th>
<th>Mirror 2 Densitometer Value</th>
<th>Mirror 3 Densitometer Value</th>
<th>Mirror 4 Densitometer Value</th>
<th>Average Mirror Cleaning Densitometer Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control (No adsorbing agent)</td>
<td>-0.23A</td>
<td>-0.31A</td>
<td>-0.35A</td>
<td>-0.93B</td>
<td>-0.45</td>
</tr>
<tr>
<td>Invention (50/50 by volume Blend of Hyperfloc® NE823F and ND823 @ 1#/ton)</td>
<td>-0.06A</td>
<td>-0.02A</td>
<td>-0.10A</td>
<td>-0.21B</td>
<td>-0.10</td>
</tr>
<tr>
<td>Hyperfloc® NE823F @ 1#/ton</td>
<td>-0.06A</td>
<td>-0.09A</td>
<td>-0.12A</td>
<td>-0.25B</td>
<td>-0.13</td>
</tr>
<tr>
<td>Hyperfloc® ND823 @ 1#/ton</td>
<td>-0.16B</td>
<td>-0.05A</td>
<td>-0.14AB</td>
<td>-0.3C</td>
<td>-0.16</td>
</tr>
<tr>
<td>Article of manufacture</td>
<td>Mirror 1 Diameter Value</td>
<td>Mirror 2 Diameter Value</td>
<td>Mirror 3 Diameter Value</td>
<td>Mirror 4 Diameter Value</td>
<td>Average Diameter Value</td>
</tr>
<tr>
<td>------------------------</td>
<td>------------------------</td>
<td>------------------------</td>
<td>------------------------</td>
<td>------------------------</td>
<td>------------------------</td>
</tr>
<tr>
<td>Hyperfloc @ ND823 @ 1#ton - low steam application</td>
<td>-0.19B</td>
<td>-0.06A</td>
<td>-0.22B</td>
<td>-0.36C</td>
<td>-0.21</td>
</tr>
<tr>
<td>Hyperfloc @ ND823 @ 1#ton - high steam application</td>
<td>-0.24B</td>
<td>-0.11A</td>
<td>-0.09A</td>
<td>-0.21B</td>
<td>-0.16</td>
</tr>
<tr>
<td>Hyperfloc @ ND823 @ 1#ton - applied to two surfaces MVF1961-039 soil adsorbing agent 99% AAM, 0.25% AA, and 0.75% MAATAC @ 2#ton</td>
<td>-0.04A</td>
<td>-0.03A</td>
<td>-0.16B</td>
<td>-0.38C</td>
<td>-0.14</td>
</tr>
<tr>
<td>MVF1961-039 soil adsorbing agent 99% AAM, 0.25% AA, and 0.75% MAATAC @ 2#ton</td>
<td>-0.03A</td>
<td>-0.08A</td>
<td>-0.26B</td>
<td>-0.45C</td>
<td>-0.21</td>
</tr>
<tr>
<td>Hyperfloc @ ND823F @ 1#ton</td>
<td>-0.25BC</td>
<td>-0.04A</td>
<td>-0.21B</td>
<td>-0.34C</td>
<td>-0.21</td>
</tr>
<tr>
<td>Hyperfloc @ ND823F @ 2#ton</td>
<td>-0.03A</td>
<td>-0.08A</td>
<td>-0.29B</td>
<td>-0.48C</td>
<td>-0.22</td>
</tr>
<tr>
<td>Mingepol HSC-300 @ 5#ton</td>
<td>-0.27A</td>
<td>-0.21A</td>
<td>-0.27A</td>
<td>-0.50B</td>
<td>-0.31</td>
</tr>
<tr>
<td>Hyperfloc @ CE1954 @ 2#ton</td>
<td>-0.11A</td>
<td>-0.27AB</td>
<td>-0.37BC</td>
<td>-0.55C</td>
<td>-0.33</td>
</tr>
<tr>
<td>Mingepol HSC-300 @ Wet-end Addition @ 10 #/ton</td>
<td>-0.36A</td>
<td>-0.27A</td>
<td>-0.32A</td>
<td>-0.58B</td>
<td>-0.38</td>
</tr>
<tr>
<td>Hyperfloc @ CE1954 Wet-end addition @ 46#ton</td>
<td>-0.28AB</td>
<td>-0.24A</td>
<td>-0.46B</td>
<td>-0.84C</td>
<td>-0.46</td>
</tr>
<tr>
<td>MVF1562-100B soil adsorbing agent 99% AAM, 0.25% AA, and 0.75% MAATAC @ 6#ton</td>
<td>-0.17AB</td>
<td>-0.10A</td>
<td>-0.28B</td>
<td>-0.51C</td>
<td>-0.27</td>
</tr>
<tr>
<td>Different Molecular Weight from MVF1961-039</td>
<td>-0.57A</td>
<td>-0.63A</td>
<td>-1.00B</td>
<td>-1.05B</td>
<td>-0.81</td>
</tr>
<tr>
<td>Bounty Mega Roll - 2011</td>
<td>-0.45A</td>
<td>-0.54A</td>
<td>-0.50A</td>
<td>-0.98B</td>
<td>-0.64</td>
</tr>
<tr>
<td>Bounty @ (Lupasol P, 4#ton, pH 4.5)</td>
<td>-0.40A</td>
<td>-0.56A</td>
<td>-0.02B</td>
<td>-1.14C</td>
<td>-0.76</td>
</tr>
<tr>
<td>Bounty @ Basic</td>
<td>-0.23A</td>
<td>-0.54A</td>
<td>-0.56A</td>
<td>-0.82A</td>
<td>-0.66</td>
</tr>
<tr>
<td>Viva @</td>
<td>-0.70A</td>
<td>-0.50A</td>
<td>-1.00B</td>
<td>-1.15B</td>
<td>-0.84</td>
</tr>
<tr>
<td>Kreger @ Nice and Strong</td>
<td>-0.62A</td>
<td>-0.61A</td>
<td>-0.88A</td>
<td>-1.29B</td>
<td>-0.85</td>
</tr>
<tr>
<td>Meijer @ Premium</td>
<td>-0.62A</td>
<td>-0.61A</td>
<td>-0.88A</td>
<td>-1.29B</td>
<td>-0.85</td>
</tr>
</tbody>
</table>
[0079] *NOTE: Hyperfloc addition to the articles of manufacture is applied equally to both plies of a two ply product except where indicated e.g. 1#/ton in total sheet all applied to the embossed side is represented as 2#/ton applied to the embossed ply and 0#/ton applied to the un-embossed side resulting in 1#/ton in total sheet. #/ton calculation for individual plies utilizes the basis weight of the individual ply as opposed to using total basis weight of multiply sheets.

[0080] In one example of the present invention, the soil adsorbing agent present in the article of manufacture exhibits a volatile organic content (VOC) of less than 20% and/or less than 15% and/or less than 10% and/or less than 5% as measured according to the VOC Test Method described herein. In another example, an article of manufacture of the present invention comprises a soil adsorbing agent that exhibits a Volatile Organic Carbon content (VOC) of greater than 20% and a second soil adsorbing agent that exhibits a Volatile Organic Carbon content (VOC) of less than 20% and/or less than 15% and/or less than 10% and/or less than 5% as measured according to the VOC Test Method described herein.

[0081] In another example of the present invention, the soil adsorbing agent present in the article of manufacture exhibits a Total Volatiles content of less than 55% and/or less than and/or less than 50% and/or less than 45% and/or less than 40% and/or less than 35% and/or less than 25% and/or less than 15% as measured according to the VOC Test Method described herein.

[0082] In another example of the present invention, the soil adsorbing agent present in the article of manufacture exhibits a Moisture content of less than 30% and/or less than 25% and/or less than 20% and/or less than 15% as measured according to the VOC Test Method described herein.

[0083] Table 2 below illustrates Total Volatiles content, Moisture content, and Volatile Organic Carbon content (as measured according to the VOC Test Method described herein) of examples of soil adsorbing agents, in this case nonionic polycryliclamides; namely, Hyperfloc® NE823E, Hyperfloc® NE823F, and Hyperfloc® ND823 (commercially available from SNF Floerger and/or Hychem, Inc.) alone and in blends with each other prepared from commercially available materials.

<table>
<thead>
<tr>
<th>Hyperfloc Material</th>
<th>Total Volatiles (%)</th>
<th>Moisture (%)</th>
<th>VOC (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NE823F</td>
<td>60.1</td>
<td>37.4</td>
<td>22.7</td>
</tr>
<tr>
<td>NE823F lot RA07/1310</td>
<td>57.3</td>
<td>35.7</td>
<td>21.6</td>
</tr>
<tr>
<td>NE823F lot RA10/1276</td>
<td>57.6</td>
<td>36.0</td>
<td>22.6</td>
</tr>
<tr>
<td>NE823F lot RA10/1216</td>
<td>57.1</td>
<td>36.9</td>
<td>20.2</td>
</tr>
<tr>
<td>NE823F lot RA07/1307</td>
<td>57.2</td>
<td>36.4</td>
<td>20.9</td>
</tr>
<tr>
<td>NE823F lot RA06/1309</td>
<td>56.9</td>
<td>35.4</td>
<td>21.5</td>
</tr>
<tr>
<td>Average NE823F</td>
<td>57.2</td>
<td>35.9</td>
<td>21.4</td>
</tr>
<tr>
<td>Std. Dev.</td>
<td>0.24</td>
<td>0.75</td>
<td>0.87</td>
</tr>
<tr>
<td>ND823 lot DA06/1216</td>
<td>14.04</td>
<td>5.31</td>
<td>8.73</td>
</tr>
</tbody>
</table>

Calculated

25/75 Blend of NE823F/ND823

50/50 Blend of NE823F/ND823

75/25 Blend of NE823F/ND823

Measured

25/75 Blend of NE823F/ND823

50/50 Blend of NE823F/ND823

75/25 Blend of NE823F/ND823

Soil Adsorbing Agents

[0084] The soil adsorbing agent of the present invention may be any suitable chemical, such as a polymer, that when applied to and/or present in an article of manufacture of the present invention provides the article of manufacture with an improved Mirror Cleaning Densitometer Value than the article of manufacture is void of the chemical as measured according to the Mirror Cleaning Test Method as described herein.

[0085] In one example, the soil adsorbing agent exhibits a weight average molecular weight of greater than 750,000 and/or greater than 1,500,000 and/or greater than 4,000,000 and/or to about 40,000,000 and/or to about 20,000,000 and/or to about 10,000,000,000.

[0086] In another example, the soil adsorbing agent exhibits a number average molecular weight of greater than 200,000 g/mol and/or greater than 500,000 g/mol and/or greater than 750,000 g/mol and/or greater than 900,000 g/mol to less than 2,000,000 g/mol and/or less than 1,750,000 g/mol and/or less than 1,500,000 g/mol. In one example, the soil adsorbing
agent exhibits a number average molecular weight of from about 500,000 g/mol to about 2,000,000 g/mol and/or from about 900,000 g/mol to about 1,700,000 g/mol.

In one example, the soil adsorbing agent of the present invention exhibits an average particle size distribution of less than 5000 d nm and/or less than 3000 d nm and/or less than 2000 d nm and/or greater than 10 d nm and/or greater than 100 d nm and/or greater than 500 d nm and/or greater than 1000 d nm.

Non-limiting examples of suitable chemicals include polymers. In one example, the soil adsorbing agent comprises a polymer comprising monomeric units derived from acrylic acid and/or amine compound and/or quaternary ammonium compounds and/or acrylamide. In another example, the soil adsorbing agent comprises monomeric units derived from acrylic acid and/or quaternary ammonium compounds and/or acrylamide. In one example, polyethyleneimines, such as Lupasol®, which is commercially available from BASF Corporation, are not suitable as soil adsorbing agents within the present invention.

In one example, the soil adsorbing agent comprises a flocculating agent as compared to a coagulating agent.

A flocculating agent is a chemical that results in colloids and other suspended particles, especially in liquids, to aggregate. An example of a flocculating agent according to the present invention is Rhodia’s Mirapol® and Hychem/ SNF’s Hyperfloc®.

A coagulating agent on the other hand, for purposes of the present invention is a chemical that results in a liquid changing into a thickened solid. An example of a coagulating agent according to the present invention is BASF Corporation’s Lupasol®.

In one example, the soil adsorbing agent comprises a homopolymer of polyacrylamide, such as Hyperfloc®, which is commercially available from Hychem, Inc.

In one example, the soil adsorbing agent may be used as a highly concentrated inverse emulsion (for example a water-in-oil emulsion), containing greater than 10% and/or greater than 15% and/or greater than 20% and/or greater than 25% and/or greater than 30% and/or greater than 35% and/or to about 60% and/or to about 55% and/or to about 50% and/or to about 45% active. The oil phase may consist of high quality mineral oil with boiling point range of 468-529°F or a heavy mineral oil with boiling point range of 608-968°F. In another example the oil phase containing suspended continuous oil phase, containing a higher amount and/or greater than 15% and/or greater than 20% and/or greater than 25% and/or greater than 30% and/or greater than 20% and/or greater than 25% and/or greater than 30% and/or greater than 35% and/or to about 60% and/or to about 55% and/or to about 50% and/or to about 45% active. The oil phase may consist of high quality mineral oil with boiling point range of 468-529°F or a heavy mineral oil with boiling point range of 608-968°F. In another example, the oil phase of the water-in-oil emulsion comprises a hydrocarbon fluid, such as white mineral oil, that exhibits a VOC content of less than 60% as measured according to the VOC Test Method and an emulsifying surfactant and/or inverting surfactant. In addition, the soil adsorbing agent of the water-in-oil emulsion may exhibit a net charge density of greater than -5 meq/g to less than 5 meq/g and/or from greater than -5 to about -0.1 meq/g as measured according to the Charge Density Test Method, described herein. In still another example, the soil adsorbing agent may exhibit a UL Viscosity of from about 1 to about 6 cP as measured according to the UL Viscosity Test Method described herein.

In one example, the soil adsorbing agent may be used as a highly concentrated inverse emulsion wherein the continuous phase of the inverse emulsion comprises mineral oil, such as white mineral oil.

In still another example, the soil adsorbing agent may be used as a dewatered inverse emulsion, such as Hyperfloc® ND823, ADS89, and CD864, which are commercially available from SNF Floerger and/or Hychem, Inc., which consist of micron size particles of highly coiled polymer in a continuous oil phase.

The inverse emulsions of the present invention may be directly applied to a surface of an article of manufacture, such as a surface of a dry fibrous structure, a surface of a wet fibrous structure and/or added to the wet-end of a papermaking process.

In one example, the soil adsorbing agent comprises a blend of two or more soil adsorbing agents. In one example, the soil adsorbing agent comprises a blend of a polyacrylamide water-in-oil emulsion (such as Hyperfloc® NE823F) and a polyacrylamide dewatered inverse emulsion (such as Hyperfloc® ND823). In one example, the blend comprises 50% by volume or greater and/or 60% or greater by volume and/or 75% or greater by volume and/or 80% by volume or greater.

In one example, the soil adsorbing agent of the present invention is water soluble.

Typically, the addition of aqueous solutions onto the dry tissue is challenging due to limitations on the amount of water that can be applied to the dry sheet without significantly degrading sheet structure and the high viscosity of higher solids content (greater than about 2% active) solutions. High viscosity solutions are more prone to bridging of polymer and thus bonding between individual sheets on a roll which may cause tearing as individual sheets are removed from the roll. Additionally, the slow penetration of the polymer into the sheet causes more severe polymer buildup on rolls and other surfaces exposed to the sheet in the converting process. Utilization of water in oil emulsions such as Hyperfloc NE823F overcomes the process issues associated with addition of high viscosity aqueous solutions, however, water in oil emulsions exhibit a high content of Volatile Organic Compounds significantly increasing VOC’s and requiring additional major permitting and/or implementation of Best Available Control Technology. Utilization of dewatered emulsions such as Hyperfloc® ND823 dramatically decreases VOC content. However, it was observed that dewatered polyacrylamide emulsions exhibit lower mirror cleaning performance than its water in oil emulsion equivalent Hyperfloc NE823F. This deficiency is most apparent when cleaning the first mirror and in fact the majority of the data show that cleaning performance improves on the second and in some cases the third mirror relative to the first mirror. This initial lag in performance could minimize the favorable consumer response observed with Hyperfloc NE823F.

In light of the foregoing, it is clear that a low VOC content emulsion that improves initial e.g., first mirror cleaning performance relative to Hyperfloc ND823 is needed. In this regard it was surprisingly discovered that blends of Hyperfloc NE823F/ND823 formed stable emulsions and that the presence of a small percentage of water in oil emulsion improves initial cleaning performance.
Processes for Making Article of Manufacture

[0101] The article of manufacture of the present invention may be made by any suitable process known in the art. For example, if the article of manufacture is a web, any suitable web making process can be used.

[0102] In one example, the article of manufacture comprises a fibrous structure. The fibrous structure may be made by a process comprising the step of contacting a surface of the fibrous structure with a soil adsorbing agent according to the present invention. We have surprisingly found that direct application of the high active content water in oil emulsion to the dry sheet can be accomplished without significantly disrupting the sheet structure and providing for improved VFS absorbent capacity in much the same way as superabsorbent polymers without the negative consumer response associated with release of visible super absorbent gel particles contaminating the surface being cleaned or the consumers hands.

[0103] In another example of a process for making an article of manufacture, such as a fibrous structure, comprises the steps of:

[a] providing a fiber slurry;
[b] depositing the fiber slurry onto a foraminous wire to form an embryonic web;
[c] drying the embryonic web to produce a fibrous structure; and
[d] contacting the fibrous structure with a soil adsorbing agent to produce an article of manufacture (a fibrous structure, for example a dry fibrous structure) in accordance with the present invention.

[0108] In yet another example of a process for making an article of manufacture, such as a fibrous structure, comprises the steps of:

[a] providing a fiber slurry comprising a soil adsorbing agent;
[b] depositing the fiber slurry onto a foraminous wire to form an embryonic web; and
[c] drying the embryonic web to produce an article of manufacture (a fibrous structure, for example a dry fibrous structure) in accordance with the present invention; and
[d] optionally, contacting the article of manufacture with a soil adsorbing agent.

[0113] The fiber slurry may comprise permanent and/or temporary wet strength agents such as Kynene® (permanent wet strength) and Hercobond® (temporary wet strength) both available from Ashland Inc.

[0114] In still yet another example of a process for making an air-laid fibrous structure comprises the steps of:

[a] providing pulp fibers;
[b] producing an air-laid fibrous structure from the pulp fibers; and
[c] contacting a surface of the air-laid fibrous structure with a soil adsorbing agent according to the present invention.

[0118] In one example, the soil adsorbing agent may be added to a fibrous structure of the present invention during papermaking, between the Yankee dryer and the reel, and/or during converting by applying it to one or more surfaces of the fibrous structure. In one example, a single-ply paper towel comprises the soil adsorbing agent on one surface of the paper towel. In another example, a single-ply paper towel comprises the soil adsorbing agent on both surfaces of the paper towel. In still another example, a two-ply paper towel comprises the soil adsorbing agent on one or both exterior surfaces of the two-ply paper towel. In still another example, a two-ply paper towel comprises the soil adsorbing agent on one or more exterior surfaces of the two-ply paper towel. In yet another example, a two-ply paper towel comprises the soil adsorbing agent on one or more exterior surfaces and one or more interior surfaces of the two-ply paper towel. One of ordinary skill would understand that exterior surfaces and various interior surfaces of a three or more ply paper towel could comprise the soil adsorbing agent.

[0119] In still another example, an emulsion, an inverse emulsion, of the soil adsorbing agent may be added to the fiber slurry in the wet-end addition of a papermaking process by adding the neat inverse emulsion as received or after inverting the emulsion by forming a dilute 0.1-0.2% active solids aqueous solution of the soil adsorbing agent into suction of fan pump of a paper machine.

[0120] In one example, the article of manufacture may be made by adding a soil adsorbing agent into the wet end of a wet laid papermaking process. In other words, the soil adsorbing agent may be added to a fiber slurry comprising hardwood and/or softwood fibers prior to depositing the slurry onto a foraminous wire.

[0121] In another example, the article of manufacture of the present invention may be made by printing a soil adsorbing agent onto a surface of an article of manufacture, such as a fibrous structure, for example in a converting operation. The printing operation may occur by any suitable printing equipment, for example by way of a gravure roll.

[0122] In still another example, an article of manufacture of the present invention may be made by extruding a soil adsorbing agent onto a surface of an article of manufacture, such as a fibrous structure.

[0123] In even another example, an article of manufacture of the present invention may be made by spraying a soil adsorbing agent onto a surface of an article of manufacture, such as a fibrous structure.

[0124] In yet another example, an article of manufacture of the present invention may be made by spraying a soil adsorbing agent onto a wet fibrous structure during papermaking after the vacuum dewatering step, but before the predryers and/or after the predryers, but before the Yankee.

[0125] In one example, one or more soil adsorbing agents may be added to a fibrous structure in the wet-end, in the fibers prior to inclusion into a fiber slurry, and/or during papermaking and/or during converting of the fibrous structure and/or to a finished fibrous structure, such as a paper towel. For example, a first soil adsorbing agent may be added to a fibrous structure in the wet-end and second soil adsorbing agent, the same or different as the first, may be added to the fibrous structure during papermaking and/or converting.

[0126] A soil adsorbing agent comprising Hyperfloc® NE823F represents an APE free, non-ionic water-in-oil emulsion (about 30% active-about 30% polyacrylamide, 30% water, 30% high boiling oil, and 10% surfactants) available from Hychem, Inc. under the trade name NE823F. A soil adsorbing agent comprising Hyperfloc® ND823 represents a dewatered emulsion consisting of (about 50% active-about 50% polyacrylamide, 40% high boiling oil and 10% surfactants). A blend (mixture) of the Hyperfloc® NE823F and ND823, for example via low shear mixing, result in a stable emulsion with no obvious settling. Formulations ranging from 100% NE823F to 100% ND823 were found to be stable with minimal short duration low shear mixing as is typically recommend with water in oil emulsion products. A 50/50
volume blend is prepared. Other blends such as 25/75 and/or 75/25 by volume of NE823F and ND823 may be utilized. The Hyperfloc® 50/50 volume blend emulsion of NE823F/ND823 is applied directly to an embossed surface of a fibrous structure via an extruder in converting utilizing an S-wrap configuration such that the extruder is positioned below the sheet with full wrap over the extruder head. Alternatively, dual side extrusion may be utilized.

[0127] In yet another example, an article of manufacture of the present invention may be made by depositing a plurality of fibers mixed with a soil adsorbing agent in an air-laid and/or coform process.

[0128] In still another example, an article of manufacture may be made that contains soil adsorbing agents including the soil adsorbing agents at acceptable locations within spun-bonding, meltblowing, carding, and/or hydroentangling processes.

[0129] The soil adsorbing agent may be applied to and/or included in an article of manufacture in a pattern, such as a non-random, repeating pattern.

NON-LIMITING EXAMPLES

Example 1

[0130] Articles of manufacture, in particular fibrous structures; namely, paper towels are produced utilizing a cellulose furnish consisting of a Northern Softwood Kraft (NSK) and Eucalyptus Hardwood (EUC) at a ratio of approximately 65/35. The NSK is refined as needed to maintain target wet burst at the reel. Any furnish preparation and refining methodology common to the papermaking industry can be utilized.

[0131] A 3% active solution Kynene 1142 is added to the refined NSK line prior to an in-line static mixer and 1% active solution of Wickit 1285, an ethoxylated fatty alcohol defoamer available from Ashland Inc. is added to the EUC furnish. The addition levels are 20 and 1 lbs/ton of paper, respectively.

[0132] The NSK and EUC thick stocks are then blended into a single thick stock line followed by addition of 1% active carboxymethylcellulose (CMC) solution at 7 lbs/ton of paper towel, and optionally, a softening agent may be added.

[0133] The thick stock is then diluted with white water at the inlet of a fan pump to a consistency of about 0.15% based on total weight of NSK and EUC fiber. The diluted fiber slurry is directed to a non-layered configuration headbox such that a wet web produced from the fiber slurry is formed onto a Fourdrinier wire (foraminous wire).

[0134] Dewatering occurs through the Fourdrinier wire and is assisted by deflector and vacuum boxes. The Fourdrinier wire is of a 5-shed, satiny weave configuration having 84 machine-direction and 78 cross-direction monofilaments per inch, respectively. The speed of the Fourdrinier wire is about 675 fpm (feet per minute).

[0135] The embryonic wet web is transferred from the Fourdrinier wire at a fiber consistency of about 22% at the point of transfer to a patterned belt through-air-drying resin carrying fabric. To provide fibrous structure products of the present invention, the speed of the patterned through-air-drying fabric is about 18% slower than the speed of the Fourdrinier wire (for example a wet molding process). In another example, the embryonic wet web may be transferred to a patterned belt and/or fabric where the speed of the patterned through-air-drying fabric is approximately the same as the speed of the Fourdrinier wire.

[0136] Further de-wetting is accomplished by vacuum assisted drainage until the web has a fiber consistency of about 26-28%.

[0137] While remaining in contact with the patterned drying fabric, the web is pre-dried by air blow-through pre-driers to a fiber consistency of about 65% by weight.

[0138] After the pre-driers, the semi-dry web is transferred to a Yankee dryer and adhered to the surface of the Yankee dryer with a sprayed creping adhesive. The creping adhesive is an aqueous dispersion with the actives consisting of about 2#/ton polyvinyl alcohol, and 0.5#/ton of release aid (CREPETROL® R6390). Crepe aids such as CREPETROL® A3025 may also be utilized. CREPETROL® A3025 and CREPETROL® R6390 are commercially available from Ashland Inc. (formerly Hercules Inc.). The creping adhesive is delivered to the Yankee surface at a rate of about 0.15% adhesive solids based on the dry weight of the web. The fiber consistency is increased to about 97% before the web is dry creped from the Yankee with a doctor blade.

[0139] The doctor blade has a bevel angle of about 45° and is positioned with respect to the Yankee dryer to provide an impact angle of about 101°. The Yankee dryer is operated at a temperature of about 177°C, and a speed of about 550 fpm. The fibrous structure is wound in a roll using a surface driven reel drum having a surface speed of about 610 fpm. In another example, the doctor blade may have a bevel angle of about 25° and is positioned with respect to the Yankee dryer to provide an impact angle of about 81° and the reel is run about 10% slower than the speed of the Yankee.

[0140] A first soil adsorbing agent comprising a dewatered (dehydrated) Hyperfloc® emulsion of micron size polymer particles dispersed in oil (about 50% active-about 50% polycrylicamide, 40% high boiling oil, and 10% surfactants) available from Hychem, Inc. under the trade name ND823 is applied directly to a surface of a fibrous structure in the converting operation via an extruder to the embossed side of a two-ply product. Additionally, a second extruder can be utilized to apply soil attracting polymer to the un-embossed side of the sheet.

[0141] A second soil adsorbing agent comprising a Hyperfloc® water-in-oil emulsion (about 30% active-about 30% polycrylicamide, 30% water, 30% high boiling oil, and 10% surfactants) with the active polymer consisting of highly coiled polymer dissolved in micron size water droplets available from Hychem, Inc. under the trade name NE823F, which is the non-dewatered (not-dehydrated) form of Hyperfloc® ND823, is applied directly to a surface of a fibrous structure via a spray application in papermaking onto the fabric side and/or the wire side of the dry fibrous structure between the calender and the reel. Alternatively extruder application in converting can be utilized.

[0142] The fibrous structure may be embossed prior to and/or subsequent to the application of one or both of the soil adsorbing agents. It may then be subsequently converted into a two-ply paper towel product having a basis weight of about 28-33 lbs/5000 ft² with fabric side out and/or wire side out.

Example 2

[0143] Articles of manufacture, in particular fibrous structures; namely, paper towels are produced utilizing a cellulose furnish consisting of a Northern Softwood Kraft (NSK) and Eucalyptus Hardwood (EUC) at a ratio of approximately...
The NSK is refined as needed to maintain target wet burst at the reel. Any furnish preparation and refining methodology common to the papermaking industry can be utilized.

A 3% active solution Kymene 1142 is added to the refined NSK line prior to an in-line static mixer and 1% active solution of Wickit 1285, an ethoxyated fatty alcohol defoamer available from Ashland Inc. is added to the EUC furnish. The addition levels are 20 and 1 lbs active/ton of paper, respectively.

The NSK and EUC thick stocks are then blended into a single thick stock line followed by addition of 1% active carboxymethylcellulose (CMC) solution at 7 lbs active/ton of paper towel, and optionally, a softening agent may be added.

The thick stock is then diluted with white water at the inlet of a fan pump to a consistency of about 0.15% based on total weight of NSK and EUC fiber. The diluted fiber slurry is directed to a non-layered configuration headbox such that a wet web produced from the fiber slurry is formed onto a Fourdrinier wire (foraminous wire).

Dewatering occurs through the Fourdrinier wire and is assisted by deflector and vacuum boxes. The Fourdrinier wire is of a 5-shed, satin weave configuration having 84 machine-direction and 78 cross-direction monofilaments per inch, respectively. The speed of the Fourdrinier wire is about 675 fpm (feet per minute).

The embryonic wet web is transferred from the Fourdrinier wire at a fiber consistency of about 22% at the point of transfer to a patterned belt through-air-drying resin carrying fabric. To provide fibrous structure products of the present invention, the speed of the patterned through-air-drying fabric is about 18% slower than the speed of the Fourdrinier wire (for example a wet molding process). In another example, the embryonic wet web may be transferred to a patterned belt and/or fabric where the speed of the patterned through-air-drying fabric is approximately the same as the speed of the Fourdrinier wire.

Further de-watering is accomplished by vacuum assisted drainage until the web has a fiber consistency of about 26-28%.

While remaining in contact with the patterned drying fabric, the web is pre-dried by air blow-through pre-dryers to a fiber consistency of about 65% by weight.

The pre-dryers, the semi-dry web is transferred to a Yankee dryer and adhered to the surface of the Yankee dryer with a sprayed creping adhesive. The creping adhesive is an aqueous dispersion with the actives consisting of about 2%/ton polyvinyl alcohol, and 0.5%/ton of release aid (CREPETROL® R6390). Crepe aids such as CREPETROL® A3025 may also be utilized. CREPETROL® A3025 and CREPETROL® R6390 are commercially available from Ashland Inc. (formerly Hercules Inc.). The creping adhesive is delivered to the Yankee surface at a rate of about 0.15% adhesive solids based on the dry weight of the web. The fiber consistency is increased to about 97% before the web is dry creped from the Yankee with a doctor blade.

The doctor blade has a bevel angle of about 45° and is positioned with respect to the Yankee dryer to provide an impact angle of about 81°. The Yankee dryer is operated at a temperature of about 177° C. and a speed of about 550 fpm. The fibrous structure is wound in a roll using a surface driven reel drum having a surface speed of about 610 fpm. In another example, the doctor blade may have a bevel angle of about 25° and is positioned with respect to the Yankee dryer to provide an impact angle of about 81° and the reel is run about 10% slower than the speed of the Yankee.

A soil adsorbing agent comprising Hyperfloc® NE823F represents an APEE free, non-ionic water-in-oil emulsion (about 30% active-about 30% polyacrylamide, 30% water, 30% high boiling oil, and 10% surfactants) available from Hychem, Inc. under the trade name NE823F. A soil adsorbing agent comprising Hyperfloc® NDB823 represents a dewatered emulsion consisting of (about 50% active-about 50% polyacrylamide, 40% high boiling oil and 10% surfactants). A blend (mixture) of the Hyperfloc® NE823F and NDB823, for example via low shear mixing, result in a stable emulsion with no obvious settling. Formulations ranging from 100% NE823F to 100% NDB823 were found to be stable. A 50/50 volume blend is prepared. The Hyperfloc® 50/50 volume blend emulsion of NE823F/NDB823 is applied directly to an embossed surface of a fibrous structure via an extruder in converting utilizing an S-wrap configuration such that the extruder is positioned below the sheet with full wrap over the extruder head. Alternatively, dual side extrusion may be utilized.

The fibrous structure may be subsequently converted into an embossed, two-ply paper towel product having a basis weight of about 28-33 lbs/3000 ft² with fabric side out and/or wire side out.

Test Methods

Unless otherwise specified, all tests described herein including those described under the Definitions section and the following test methods are conducted on samples that have been conditioned in a conditioned room at a temperature of 23° C±1.0°C. and a relative humidity of 50±2% for a minimum of 2 hours prior to the test. All plastic and paper board packaging materials of manufacture must be carefully removed from the paper samples prior to testing. The samples tested are “usable units.” “Usable units” as used herein means sheets, flats from roll stock, pre-converted flats, and/or single or multi-ply products. Except where noted all tests are conducted in such conditioned room, all tests are conducted under the same environmental conditions and in such conditioned room. Discard any damaged product. Do not test samples that have defects such as wrinkles, tears, holes, and like. Samples conditioned as described herein are considered dry samples (such as “dry filaments”) for testing purposes. All instruments are calibrated according to manufacturer’s specifications.

Basis Weight Test Method

Basis weight of a fibrous structure is measured on stacks of twelve usable units using a top loading analytical balance with a resolution of ±0.001 g. The balance is protected from air drafts and other disturbances using a draft shield. A precision cutting die, measuring 3,500 in.±0.0035 in. by 3,500 in.±0.0035 in is used to prepare all samples.

With a precision cutting die, cut the samples into squares. Combine the cut squares to form a stack of twelve samples thick. Measure the mass of the sample stack and record the result to the nearest 0.001 g.

The Basis Weight is calculated in lbs/3000 ft² or g/m² as follows:

\[
\text{Basis Weight} = \frac{\text{Mass of stack}}{\left(\frac{\text{Area of 1 square in stack}}{\text{No. of squares in stack}}\right)}\]
For example,
\[
\text{Basis Weight (lbs/3000 ft}^2\text{)=}\frac{\text{Mass of stack (g)}}{453.6 \text{ (g/lbs)} \times 12.25 \text{ (in)} \times 144 \text{ (in/ft)} \times 12 \times 3000}
\]
or,
\[
\text{Basis Weight (g/m}^2\text{)=}\frac{\text{Mass of stack (g)}}{79,032 \text{ (cm}^2\text{)} \times 10,000 \text{ (cm/m}^2\text{)}} \times 12\]

Report result to the nearest 0.1 lbs/3000 ft\(^2\) or 0.1 g/m\(^2\). Sample dimensions can be changed or varied using a similar precision cutter as mentioned above, so as at least 100 square inches of sample area in stack.

**Moisture Content Test Method**

**[0159]** The moisture content present in an article of manufacture, such as a fibrous structure is measured using the following Moisture Content Test Method. An article of manufacture or portion thereof (“sample”) is placed in a conditioned room at a temperature of 23°C ±1.0°C and a relative humidity of 50% ±2% for at least 24 hours prior to testing. Each fibrous structure sample has an area of at least 4 square inches, but small enough in size to fit appropriately on the balance weighing plate. Under the temperature and humidity conditions mentioned above, using a balance with at least four decimal places, the weight of the sample is recorded every five minutes until a change of less than 0.5% of previous weight is detected during a 10 minute period. The final weight recorded is the “equilibrium weight.” Within 10 minutes, the sample is placed into a forced air oven on top of a rack for 24 hours at 70°C ±2°C. At a relative humidity of 40% ±2% for drying. After the 24 hours of drying, the sample is removed and weighed within 15 seconds. This weight is designated as the “dry weight” of the sample.

The moisture content of the sample is calculated as follows:

\[
\% \text{ Moisture in sample}=\frac{\text{Sample weight} - \text{Dry weight of sample}}{\text{Dry weight of sample}}\times 100\%
\]

The % Moisture in sample for 3 replicates is averaged to give the reported % Moisture in sample.

Report results to the nearest 0.1%.

**Mirror Cleaning Test Method**

**[0160]** A test stand cart holding 4 individual 28” x 28” mirrors (one on each of the 4 sides) resting on a flat surface, such as a floor, is used for the mirror cleaning test. The silver mirror layer is on the back surface of a flat clear glass sheet approximately 5 mm thick. The cart is configured such that the bottom edge of each mirror is approximately 3” off the flat surface.

**[0161]** The mirror is prepared for testing by cleaning as follows: 1) Windex® commercially available from SC Johnson (composition containing 0.1-1.0% by weight of Ethyleneeglycol Monoazethylether, 1.0-5.0% by weight of Isopropanol, and 90-100% by weight of Water) or equivalent is sprayed (4 full sprays, about 3.5 g of solution) onto the mirror surface which is then spread across the entire surface of the mirror with 2 sheets of a 1-ply paper towel, for example 2010 commercially available Bounty® Basic (folded into quarters) using a circular wiping motion; 2) the mirror surface is then wiped dry and lightly polished with the essentially dry side of the folded 1-ply paper towel; 3) wiping the mirror surface with an additional two sheets of the 1-ply paper towel saturated with deionized water; and 4) using a squeegee in a top to bottom motion to remove all excess deionized water. Steps 3) & 4) may be repeated as necessary to achieve a streak and smudge free mirror surface that has no residual impact on the cleaning performance of subsequent test articles of manufacture. Any suitable absorbent substrate can be used in place of Bounty Basic that is not impregnated with polymers that may be deposited onto the glass surface, which may impact the ease or difficulty of cleaning with subsequent test article of manufacture.

**[0162]** A model soil suspension is prepared by suspending 1% by weight of Black Todd Clay in a 50:50 weight ratio of water/isopropyl alcohol mixture containing 0.05% by weight of 100% soybean oil (viscosity of from 150 to 200 cP).

**[0163]** Preparation of 100% cooked soybean oil is as follows, Approx. 100% 200 grams of 100% soybean oil available from Spectrum Chemical Manufacturing Corp., 14422 S. San Pedro St., Gardena, Calif. 90248 is placed in a 1000 mL beaker with stir bar. The soybean oil in the beaker is placed on a hot plate and heated to 204°C while stirring slowly. Air is added through a glass pipette tip set to bubble continuously through the oil. The oil is cooked continuously until viscosity, at 25°C ±2.2°C, is between 150 and 200 cP. The color changes to a dark orange. Viscosity is measured using a Cannon-Ubbelohde Viscometer tube # 350 available from Cannon Instrument Company, State College, Pa. 16803, or equivalent viscometer. A sample of oil which is near room temperature is added to the viscometer and equilibrated to 25°C in a constant temperature water bath. The efflux time for the meniscus to pass from the top mark to the bottom mark is measured to within ±0.01 second while allowing the oil to flow through the viscometer tube under gravity. Kinematic viscosity in mm\(^2\)/s is calculated by multiplying the time in seconds by the calibration constant supplied with the viscometer tube. Separately the fluid density is determined by measuring the weight of a fixed volume of oil using a 25 mL volumetric flask and a 4 place analytical balance. Viscosity in cP can be calculated by multiplying the Kinematic viscosity by density of oil in g/mL. The cooling time will vary depending on quantity, surface area and air flow through the oil.

**[0164]** The following procedure is used to apply model soil to the clean mirror surfaces. The target amount of model soil sprayed is 44 g/+−2.5 g. A spray bottle, part # 0245-01 available from www.SKS-bottle.com or equivalent spray bottle is used to spray the model soil suspension onto the mirror surface. Fill the spray bottle with the model soil suspension and weigh to the nearest 0.01 g and record as initial weight. The spray bottle is then manually pressurized as needed to achieve a dispersed spray of fine droplets. Additional pressurization is required between each mirror. Holding the spray bottle about 1.5 feet from the mirror surface a substantially horizontal sweeping motion is used starting at the top of the mirror surface and working down to the bottom of the mirror surface traversing the mirror surface a total of 8 times while attempting to have relatively even coverage on the mirror surface. After applying the model soil suspension to all 4 mirrors, the spray bottle and remaining contents are weighed to the nearest 0.01 g and recorded as weight after first spray. The mirrors are dried sequentially using a handheld hair dryer. The difference between the initial weight and after first spray is used to adjust the amount of spray applied in a second application to achieve the target amount of 44 g/+−2.5 g. The second application of the model soil suspension is applied to each mirror surface in a circular motion, moving from the outside (approximately 5-10 inches from the side edges) inward.
toward the center. After drying the second application of model soil suspension the mirrors are ready to be cleaned with an article of manufacture ("specimen") to be tested. If the time between soil application and cleaning of the mirrors with a test sample extends past 30 minutes, the mirrors need to be returned to their pristine condition using the procedure defined previously after which the soil application procedure can be repeated.

A specimen of a test article of manufacture, for example a paper towel, is prepared as follows. Two sheets of the article of manufacture, for example a paper towel, may be delineated and connected to adjacent sheets by perforation or tear lines or the sheets of the sample may be individual sheets, such as in the form of individual wipes, napkins, and/or facial tissues. If the article of manufacture, for example a paper towel, is a select-a-size format, then 4 sheets are used. Individual sheet dimensions or in the case of select-a-size two sheets vary by brand from about 8.5"x11" to 14"x11" and 2.20 g to 5.2 g. The 2 or for select-a-size 4 sheet specimen is folded in half as shown in FIG. 1 (along perforations if present) with the emboss side out (where applicable). As shown in FIG. 1, the folded sample is then folded in half again with the crease perpendicular to the MD direction and then folded in half again perpendicular to the CD direction such that a sample pad of quarter size sheet that is 8 sheets thick is formed, each sheet may consist of 1, 2 or more individual plies. In the case of articles of manufacture with single side application of soil attracting polymer it is important to fold the sheet such that the side containing the soil attracting polymer directly contacts the surface of the mirror. The mirror surface is then treated with 5 full sprays of Windex: two at top; one in the center and two in the lower area of the mirror. The weight of Windex sprayed per mirror is about 4.55 g/5.26 g. The mirror surface is then cleaned by grasping the sample pad in the hand, clamping the substrate between the thumb and index finger with firm pressure in a cross direction, while holding the sheet (side 1) as flat as possible upon the surface of the mirror and avoiding contacting the mirror with any part of the hand using 8 side-to-side passes, such that the full surface of the mirror is contacted. The sample pad is then turned over and the relatively dry backside (side 2) is used to wipe the mirror surface in an up and down motion, with firm pressure applied using 14 passes, ensuring that the entire surface of the mirror is contacted, again holding the sample pad as flat against the mirror surface as possible. The sample pad is then unfolded once and then folded back on itself revealing a relatively fresh sample pad surfaces to clean the second mirror after application of Windex as discussed above; side 3 (opposite side 1) is used for the side-to-side wiping and then turned over to side 4 (opposite side 2) for the up and down wiping. The pad is then unfolded twice to reveal a fresh surface of the specimen. The specimen is then folded in half such that the fresh sample surface is visible with the two used areas of the first sample pad configuration (sides 1 and 3) facing each other and then folded again to clean the third mirror surface after application of Windex as discussed above. Side 5 opposite side 1 and 3 is used first and then turned over to side 6 for the second up and down wiping. The sample pad is then unfolded once and then folded back on itself revealing sides 7 and 8 to clean the fourth mirror surface after application of Windex as discussed above. Side 7 opposite sides 5, 3 & 1 is used for the side-to-side wiping and then turned over to side 8 for the final up and down wiping. In each case the wettest part of the folded sample pad is used for the side-to-side wiping and the dryer side for the final up and down wiping.

All 4 mirror surfaces should be cleaned sequentially such that minimal drying of the specimen pad occurs. After cleaning all four mirror surfaces, the mirror surface is permitted to dry and each mirror surface’s optical density is measured utilizing an X-Rite 518 Spectrodensitometer. A full calibration as described in the operator’s manual is performed. The instrument is set-up per instructions in the manual in Density minus Reference Measurement Mode. The four 29°x29° mirror surfaces were cleaned as described above representing a pristine condition. A single reading of a mirror in pristine condition is completed and stored as Ref1 and is used as a reference for all subsequent measurements. A series of 9, 12, or 15 measurements are made on each of the 4 mirrors (3, 4, or 5, respectively, across the top, 3, 4, or 5, respectively, across the middle and 3, 4, or 5, respectively, across the bottom always maintaining a minimum of 3 inches from any edge of the mirror) as shown in FIG. 2 for example. The mirror cleaning test setup is oriented in the lab such that there is no direct overhead lighting and rotated such that the mirror being measured is facing towards an interior wall thus minimizing any influence caused by external lighting differences. Measurements were performed on each of the pristine mirrors. These 9, 12, or 15 individual values are averaged for each mirror. The average values were found to be consistent between mirrors, however, as expected the average shows a small difference from the single point reference. This difference is used to correct all subsequent average values measured. Additionally, average values were determined for mirrors after application of the model soils. After, following the cleaning procedure with the sample specimen, 9, 12, or 15 density readings are performed and an average Densitometer Value is reported for each of the individual mirrors. The Average Mirror Cleaning Densitometer Value is the average of the average Densitometer Values across all 4 mirrors. The orientation of the mirrors and room lighting is such that streaks are not readily visible thus ensuring a random location of each measurement taken within the limitations of the 3x3, 3x4, or 3x5 grid described above.

Volatile Organic Carbon (VOC) Test Method

The VOC content of an article of manufacture, expressed in units of weight of VOC per weight of polymer (soil adsorbing agent(s)), and shall be determined as follows. The VOC content of water in oil emulsions and dewatered emulsions is determined utilizing EPA method 24. Specifically the following procedure was utilized:

% volatiles:

1. Weigh an Al drying pan utilizing a 4 place analytical balance.
2. Equilibrate sample by gently mixing to insure representative sampling.
3. Add approximately 1 gram of neat material to the preweighed Al dry pan and weigh on the 4 place analytical balance.
4. Weight in step 3 minus the weight in step 1 equals the sample weight.
5. Place Al pan with sample into oven at 105°C for 1 hour.
6. Remove the Al pan and dry sample from oven and place in a desiccator to cool.
7. Reweigh Al pan+dried and cooled sample on 4 place analytical balance.
8. Difference in weight of step 7 minus step 1 equals the residual weight.

9. Residual weight determined in step 8 divided by the sample weight in step 4x100-% solids at 105° C.

10. 100 minus % solids determined in step 9 equals % volatile at 105° C.

% moisture by Karl Fischer:

The industry standard volumetric titration using a Mettler DL18 or DL31 Karl Fischer specific titrator, a two component reagent system and a Mettler DM143-SC double platinum pin electrode. Alternatively, moisture can be determined by ASTM D 4017.

% VOC:

% VOC-% Volatiles-% Moisture.

Charge Density Test Method

If one has identified or knows the soil adsorbing agent in and/or on an article of manufacture, then the charge density of the soil adsorbing agent can be determined by using a Mutek PCD-04 Particle Charge Detector available from BTG, or equivalent instrument. The following guidelines provided by BTG are used. Clearly, manufacturers of articles of manufacture comprising soil adsorbing agents know what soil adsorbing agent(s) are being included in their articles of manufacture. Therefore, such manufacturers and/or suppliers of the soil adsorbing agents used in the articles of manufacture can determine the charge density of the soil adsorbing agent.

Start with a 0.1% solution (0.1 g soil adsorbing agent+99.9 g deionized water). Preparation of dilute aqueous solutions in deionized water from inverse or dewatered inverse emulsions are performed as instructed by the supplier of the emulsions and is well known to one of ordinary skill in the art. Depending on the titrant consumption increase or decrease soil adsorbing agent content. Solution pH is adjusted prior to final dilution as charge density of many additives is dependent upon solution pH. A pH of 4.5 is used here for cationic polymers and between 6-7 for anionic polymers. No pH adjustment was necessary for the anionic polymers included in this study.

Place 20 mL of sample in the PCD measuring cell and insert piston.

Put the measuring cell with piston and sample in the PCD, the electrodes are facing the rear. Slide the cell along the guide until it touches the rear.

Pull piston upwards and turn it counter-clockwise to lock the piston in place.

Switch on the motor. The streaming potential is shown on the touch panel. Wait 2 minutes until the signal is stable.

Use an oppositely charged titrant (for example for a cationic sample having a positive streaming potential: use an anionic titrant). Titrants are available from BTG consisting of 0.001N PVSK or 0.001N PolyADMAC.

An automatic titrator available from BTG is utilized. After selecting the proper titrant, set the titrator to rinse the tubing by dispensing 10 mL insuring that all air bubbles have been purged.

Place tubing tip below the surface of the sample and start titration. The automatic titrator is set to stop automatically when the potential reaches 0 mV.

Record consumption of titrant, ideally, the consumption of titrant should be 0.2 mL to 10 mL; otherwise decrease or increase soil adsorbing agent content.

Repeat titration of a second 20 mL aliquot of the soil adsorbing agent sample.

Calculate charge demand (solution) or charge demand (solids);

\[
\text{Charge demand (eq/L) =} \frac{V \times \text{titrant used (L)} \times \text{Conc. of titrant in Normality (eq/L)}}{\text{Volume of sample titrated (L)}}
\]

\[
\text{Charge demand (eq/g) =} \frac{V \times \text{titrant used (L)} \times \text{Conc. of titrant in Normality (eq/L)}}{\text{Wt. solids of the sample or its active substance (g)}}
\]

The charge density (charge demand) of a soil adsorbing agent is reported in meq/g units.

UL Viscosity Test Method

1) Reagents and Equipment

a) NaCl, b) Deionized water, c) 9 moles Ethoxylated Nonyl Phenol (for example SYNERONIC NP9 from ICI surfactant), d) Mechanical stirrer fitted with a stainless steel shaft equipped at the end with about 2 cm radius propeller-type blades, e) High wall 600 ml beaker, f) Disposable syringes (5 mL, 2 mL and 10 mL), g) Balance with an accuracy of 0.001 g, h) Thermometer, i) 200 μm stainless steel screen.

2) Preparation of an Initial 0.5% Polymer Solution in Water

a) Obtain a clean 600 ml beaker and fill it with 100 g of deionized water, b) Start stirring with the mechanical stirrer at 500 rpm to create a vortex, c) Calculate the weight of pure emulsion (W_o) required to obtain 0.5 g of polymer, W_o=50/C, d) C is the percentage of active matter in the emulsion, e) Weigh accurately the syringe and record the weight filled (W_{f1}), f) Disperse rapidly the contents of the syringes into the vortex of the beaker, g) Let stir 30 minutes, h) Weigh the empty syringe and record the weight empty (W_{f2}), i) Calculate W=W_{f1}-W_{f2}.

3) Preparation of a 0.1% Solution of Polymer in 1M NaCl

a) Remove the beaker from the stirrer let the shaft and the blade, drain completely over the beaker, b) Place the beaker on the balance and weigh in accurately:

i) 0.2 g of ethoxylated nonyl phenol

ii) (Q_{D1}-Q_{D2}) g of deionized water, where Q_{D1}=(9.7949x10^{-1}-100.2, Q_{D2}) g of deionized water, where Q_{D1}=(9.7949x10^{-1}-100.2,
c) Let it stir again for 5 minutes at 500 rpm.

d) Then add the salt Qs in g: let it stir for 5 minutes, where Qs=0.585xW x C.

e) Resulting in a 0.1% solution of polymer in 1M NaCl.

f) The polymer solution is now ready for measurement after filtration through a 200 µm screen.

4) In the case of a High Molecular Weight Emulsion (UL Viscosity Greater than 7 cP)

a) Prepare the solution at 0.5% as in step 2.

b) Remove the beaker from the stirrer let the shaft and the blade drain completely over the beaker.

c) Place the beaker on the balance and weight accurately:

i) 0.2 g of ethoxylated nonyl phenol,

ii) (Qs) g of deionized water where Qs=W x (9.794x10^-3 x 100 = 2)

d) Let it stir again for 5 minutes at 850 rpm.

e) Then add the salt Qs in g: let it stir for 5 minutes at 850 rpm, where Qs=0.585xW x C

f) Resulting in a 0.1% solution of polymer in 1M NaCl.

g) The polymer solution is now ready for viscosity measurement after filtration through a 200 µm screen.

5) Viscosity Measurement of Polymer Solution

The viscosity is determined by means of a Brookfield viscometer model LVT with the UL adapter and a spindle speed of 60 rpm.

Vertical Full Sheet (VFS) Test Method

The Vertical Full Sheet (VFS) test method determines the amount of distilled water absorbed and retained by a fibrous structure of the present invention. This method is performed by first weighing a sample of the fibrous structure to be tested (referred to herein as the "dry weight of the sample"), then thoroughly wetting the sample, draining the wetted sample in a vertical position and then reweighing (referred to herein as "wet weight of the sample").

The absorptive capacity of the sample is then computed as the amount of water retained in units of grams of water absorbed by the sample. When evaluating different fibrous structure samples, the same size of fibrous structure is used for all samples tested.

The apparatus for determining the VFS capacity of fibrous structures comprises the following:

1) An electronic balance with a sensitivity of at least ±0.01 grams and a minimum capacity of 1200 grams. The balance should be positioned on a balance table and slab to minimize the vibration effects of floor/venchtop weighing. The balance should also have a special balance pan to be able to handle the size of the sample tested (i.e., a fibrous structure sample of about 11 in. (27.9 cm) by 11 in. (27.9 cm)). The balance pan can be made out of a variety of materials. Plexiglass is a common material used.

2) A sample support rack (FIGS. 3/3A) and sample support rack cover (FIG. 4/4A) is also required. Both the rack and cover are comprised of a lightweight metal frame, strung with 0.012 in. (0.305 cm) diameter monofilament so as to form a grid as shown in FIGS. 3/3A. The size of the support rack and cover is such that the sample size can be conveniently placed between the two.

The VFS test is performed in an environment maintained at 23±1°C and 50±2% relative humidity. A water reservoir or tub is filled with distilled water at 23±1°C to a depth of 3 inches (7.6 cm).

Eight 19.05 cm (7.5 inch)x19.05 cm (7.5 inch) to 27.94 cm (11 inch)x27.94 cm (11 inch) samples of a fibrous structure to be tested are carefully weighed on the balance to the nearest 0.01 grams. The dry weight of each sample is reported to the nearest 0.01 grams. The empty sample support rack is placed on the balance with the special balance pan described above. The balance is then zeroed (tared). One sample is carefully placed on the sample support rack. The support rack cover is placed on top of the support rack. The sample (now sandwiched between the rack and cover) is submerged in the water reservoir. After the sample is submerged for 60 seconds, the sample support rack and cover are gently raised out of the reservoir.

The sample, support rack and cover are allowed to drain vertically for 60±5 seconds, taking care not to excessively shake or vibrate the sample. While the sample is draining, the rack cover is carefully removed and all excess water is wiped from the support rack. The wet sample and the support rack are weighed on the previously tared balance. The weight is recorded to the nearest 0.01 g. This is the weight of the sample.

The procedure is repeated for with another sample of the fibrous structure, however, the sample is positioned on the support rack such that the sample is rotated 90° compared to the position of the first sample on the support rack.

The gram per fibrous structure sample absorptive capacity of the sample is defined as (wet weight of the sample−dry weight of the sample). The calculated VFS is the average of the absorptive capacities of the two samples of the fibrous structure.

The dimensions and values disclosed herein are not to be understood as being strictly limited to the exact numerical values recited. Instead, unless otherwise specified, each such dimension is intended to mean both the recited value and a functionally equivalent range surrounding that value. For example, a dimension disclosed as “40 mm” is intended to mean “about 40 mm.”

Every document cited herein, including any cross referenced or related patent or application, is hereby incorporated herein by reference in its entirety unless expressly excluded or otherwise limited. The citation of any document is not an admission that it is prior art with respect to any invention disclosed or claimed herein or that it alone, or in any combination with any other reference or references, teaches, suggests or discloses any such invention. Further, to the extent that any meaning or definition of a term in this document conflicts with any meaning or definition of the same term in a document incorporated by reference, the meaning or definition assigned to that term in this document shall govern.
While particular embodiments of the present invention have been illustrated and described, it would be obvious to those skilled in the art that various other changes and modifications can be made without departing from the spirit and scope of the invention. It is therefore intended to cover in the appended Claims all such changes and modifications that are within the scope of this invention.

What is claimed is:

1. An article of manufacture comprising greater than 0 ##/ton to less than 6 ##/ton of a soil adsorbing agent, wherein the article of manufacture exhibits a Mirror 2 Densitometer Value greater than the Mirror 1 Densitometer Value as measured according to the Mirror Cleaning Test Method and wherein the difference between the Mirror 2 Densitometer Value and the Mirror 1 Densitometer is greater than -0.20 and wherein the article of manufacture exhibits a sum of the Mirror 2 Densitometer Value and the Mirror 1 Densitometer Value of greater than -0.48 as measured according to the Mirror Cleaning Test Method.

2. The article of manufacture according to claim 1 wherein the article of manufacture exhibits a Mirror 2 Densitometer Value of greater than -0.27 as measured according to the Mirror Cleaning Test Method.

3. The article of manufacture according to claim 1 wherein the article of manufacture exhibits a Mirror 2 Densitometer Value of greater than -0.20 as measured according to the Mirror Cleaning Test Method.

4. The article of manufacture according to claim 1 wherein the article of manufacture comprises a web.

5. The article of manufacture according to claim 4 wherein the web comprises a plurality of pulp fibers.

6. The article of manufacture according to claim 4 wherein the web comprises a fibrous structure.

7. The article of manufacture according to claim 6 wherein the fibrous structure comprises a sanitary tissue product.

8. The article of manufacture according to claim 7 wherein the sanitary tissue product comprises a paper towel.

9. The article of manufacture according to claim 4 wherein the web comprises a cleaning pad.

10. The article of manufacture according to claim 1 wherein the article of manufacture comprises a foam structure.

11. The article of manufacture according to claim 1 wherein the article of manufacture exhibits a moisture level of less than 30%.

12. The article of manufacture according to claim 1 wherein the soil adsorbing agent comprises a polymer.

13. The article of manufacture according to claim 12 wherein the polymer comprises a monomeric unit derived from a quaternary ammonium compound.

14. The article of manufacture according to claim 12 wherein the polymer comprises a monomeric unit derived from an amine compound.

15. The article of manufacture according to claim 12 wherein polymer comprises a monomeric unit derived from an acrylamide compound.

16. The article of manufacture according to claim 1 wherein the soil adsorbing agent is present in the article of manufacture at a level of 5 ##/ton or less.

17. The article of manufacture according to claim 1 wherein the article of manufacture comprises a surfactant.

18. An article of manufacture comprising greater than 0 ##/ton to less than 6 ##/ton of a soil adsorbing agent, wherein the article of manufacture exhibits a Mirror 1 Densitometer Value of greater than -0.25 as measured according to the Mirror Cleaning Test Method and wherein the article of manufacture exhibits a Mirror 2 Densitometer Value that is greater than the Mirror 1 Densitometer Value as measured according to the Mirror Cleaning Test Method.

19. An article of manufacture comprising greater than 0 ##/ton to less than 6 ##/ton of a soil adsorbing agent that exhibits a VOC of less than 20% as measured according to the VOC Test Method, wherein the article of manufacture exhibits a Mirror 2 Densitometer Value greater than the Mirror 1 Densitometer Value as measured according to the Mirror Cleaning Test Method.

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