The present invention describes a method for removing contaminants from a recycled paper fiber slurry comprising adding a cationized mineral to the paper fiber slurry to form complexes between the cationized mineral and the contaminants and separating the complexes from the paper fibers.
SLURRY RECYCLED FIBERS

TREAT SLURRY TO REMOVE COARSE CONTAMINANTS

ADD CATIONIZED MINERAL TO SLURRY

MIX SLURRY TO DISPERSE CATIONIZED MINERAL

CENTRIFUGALLY CLEAN SLURRY

FIG. 1
FIG 2.
REMOVAL OF CONTAMINANTS FROM RECYCLED PAPER FIBERS

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application claims priority under 35 U.S.C. § 119(c) from U.S. Provisional Application Serial No. 60/416, 097 filed Oct. 4, 2002, which is incorporated herein by reference.

FIELD OF THE INVENTION

[0002] This application relates generally to a method of removing contaminants such as wax, adhesives and inks during processing of recycled paper fibers.

BACKGROUND OF THE INVENTION

[0003] Due to legislative and environmental pressures, recovery and consumption of recycled or secondary fibers is growing at a rapid rate. As an example, some states require at least 40% recycled fibers in newspapers printed in their state. Paper mills manufacturing these newspapers have to deal with inks and other contaminants present in the old newspaper (ONP) during reprocessing to produce new newspapers. Also, landfill spaces are dwindling due to population growth and requirements, and cost of landfilling is rising. Recoveries of papers, such as ONP and old corrugated containers (OCC) have been reported to be in the low to high 60% range which represents a substantial amount of recovered fibers. Associated with these secondary fibers or waste papers are undesirable materials or “contaminants” which can come from chemicals and other additives incorporated during the papermaking, converting, printing operations and in the subsequent waste paper recovery process. Common contaminants in waste papers are: hot melts, waxes, pressure sensitive adhesives, inks, polystyrene foams/beads, latex, plastic films, asphalt, sand and glass. Contaminants can cause sticky problems in the papermaking process and in the finished paper. Stickies can deposit in the papermaking wire or fabric, press rolls, white boxes, dryer drums necessitating frequent cleaning or wash-ups or even machine shutdown. This leads to loss in paper production and excessive usage of expensive cleaning chemicals. Additionally, stickies can cause specks, dirt, indents or pick-outs in paper resulting in paper quality downgrade selling at a lower price.

[0004] In the recycling process, contaminants are removed mechanically, chemically, and with the use of minerals such as talc, treated clay, calcium carbonate or bentonite. Chemical means employ surfactants, coagulants and flocculants. Their usefulness is limited as chemicals are sensitive to changes in pH, temperature and shear in the papermaking system. Mechanical methods use coarse and/or fine screens, centriflเครeners and flotation units. Screens operate on the principle of size separation while centriflเครeners or hydrocyclones operate on the principle of density or specific gravity differential. The common set-up in a recycling mill is coarse screens to remove large undesirable materials such as polystyrene foams/beads followed by fine screens and then centriflเครeners. There are two types of centriflเครeners: (a) forward centriflเครener, which removes materials heavier than water and (b) reverse centriflเครดer, which removes materials lighter than water. The efficiency of screens and centriflเครดeners depends on size and specific gravity differential of the contaminants and the suspending aqueous medium. Since most troublesome contaminants such as waxes, hot melts and pressure sensitive adhesives are small in size with a specific gravity close to that of pulp suspension in water (e.g. of 1.0), they are not effectively removed by screens and centriflเครดeners. However, if they can be densified by a mineral having a strong affinity to the contaminants and with a specific gravity significantly greater than 1.0, then removal of the contaminants can be effected at the centriflเครดener. One such mineral is talc with a specific gravity of about 2.7. Talc has a very strong affinity to waxes, hot melts, toner inks and adhesives compared to other minerals such as ground CaCO₃ and bentonite being used in removal of contaminants.

[0005] The most troublesome contaminants in OCC recycling are the waxes. Paperboards containing significant quantities of waxes are landfilled because presently, there is no economically viable way of treating the waxes so they will not cause deposit problems in recycling. Several laboratory and pilot plant studies on wax removal have been conducted. These studies have examined the effects of polymer beads, surfactants, cationic polymers and even carbon dioxide extraction on wax removal. For example, available literature cited the patents of Mollett, C. (U.S. Pat. GB 2,080,354 A, Feb. 3, 1982) and Mamers, H. et al (U.S. Pat. No. 4,224,102, Sep. 23, 1980) where polymer beads were added to pulp containing stickies to enhance cleaning efficiency. Lower than normal pulping temperature (120-130° F) of the recycled fibers to avoid softening of thermoplastic contaminants such as waxes followed by screening have been suggested by Rice, J. (U.S. Pat. No. 3,574,050), Mamers, H,((U.S. Pat. No. 4,188,259), Altman, N. and Bureau, W. (U.S. Pat. Nos. 3,016,323; 3,264,169). Wax removal through flotation-deinking type operation under different pH followed by skimming have been suggested. Savage, R. (U.S. Pat. No. 2,959,513) used high pH with sodium silicate and aluminum stearate while Hope, H. (U.S. Pat. No. 2,614,922) used alkyl or aryl sulfonate for acid pH environment. Von Koeppen, A. and Carrera (U.S. Pat. Nos. 3,208,089; 3,822,176) employed non-ionic surfactants at high temperature (180° F) to aid dispersal of wax in a waxed-paper furnish.

[0006] U.S. Pat. No. 6,245,195 to Marwha discloses a process for the decontamination of waste papers that includes repulping waste paper to form a slurry, adding a densifying agent and an agglomeration agent to the slurry, and subjecting the slurry to treatment with a conical cleaner to remove inks and stickies. This process, however, is sensitive to temperature, pH control and pulp consistency. Further, the method of the process requires control over the order of addition of the densifying and agglomeration agent.

[0007] Due to the significant quantities of paperboard being landfilled, a technically and economically feasible method to remove or pacify waxes and other contaminants is needed. Preferably, the method of removal will not require a change in the layout of existing plants and will not require a huge capital expense.

SUMMARY OF THE INVENTION

[0008] The present invention describes a method for removing contaminants from a recycled paper fiber slurry comprising adding cationized mineral, such as cationized
talc, to the paper fiber slurry to form complexes with contaminants and separating the complexes from the slurry. As used herein, contaminants refer to waxes, pressure sensitive adhesives, hot melts and the like that can appear in recycled paper fiber slurries. The separation can be accomplished by size separation, density separation or a combination of both. The method of the present invention can also include mixing the cationized mineral and the slurry to distribute the cationized mineral throughout the slurry, which occurs after addition to the slurry. In addition, the method of the present invention can also include the slurring or repulping of the recycled paper fibers. The slurring or repulping should occur before the cationized mineral is added to the slurry. Additionally, the slurry can be treated to remove coarse contaminants by any conventional process designed to remove coarse contaminants. Some conventional processes include screening, sieving and the like. This treatment step can occur before the cationized mineral is added to the slurry.

The present invention meets all of the above objects because the present invention does not require the paper mill to purchase any new equipment or any new raw materials, other than those typically used in the paper process. The present invention, however, uses the raw materials and the equipment in different ways and at different stages of the paper process.

These and other objects, features, and advantages of the invention will become apparent from the following best mode description, the drawings and the claims.

**BRIEF DESCRIPTION OF THE DRAWINGS**

The figures which follow depict a preferred embodiment and various alternative embodiments of the invention. The invention is not limited to the embodiments depicted herein since even further various alternative embodiments will be readily apparent to those skilled in the art.

**FIG. 1** depicts a flowchart of one embodiment of the method of the present invention.

**FIG. 2** depicts one embodiment of a process that embodies the principles of the method of the present invention.

**FIG. 3** depicts a multistage hydrocyclone design useful in the method of the present invention.

**DETAILED DESCRIPTION OF THE INVENTION**

This invention comprises a method of removing waxes and other contaminants from recycled paper fiber slurries. The description which follows describes a preferred embodiment of the invention, and various alternative embodiments. It should be readily apparent to those skilled in the art, however, that various other alternative embodiments may be accomplished without departing from the spirit or scope of the invention.

As shown in **FIG. 1**, the method of the present invention comprises adding cationized mineral to a paper fiber slurry to form complexes between cationized mineral and contaminants and separating the complexes from the paper fibers. The method of the present invention can include a pre-step of slurring the paper fibers. The recycled paper fibers should be slurried to contain solids in the range of about 0.1 percent to about 10 percent. More preferably, the solids range for the paper pulp slurry is in the range of about 0.1 percent to about 2.0 percent. Even more preferably, the solids range for the paper pulp slurry is in the range of about 0.4 percent to about 1.0 percent. Once the paper pulp fibers have been slurried, cationized mineral can be added to the slurry or the slurry can be passed through screens or sieves in order to remove coarse contaminants. If the slurry is passed through the screens, the screens should have a mesh size that allows coarse contaminants of greater than about 100 microns in diameter to be removed from the slurry.

The mineral of the present invention can be any mineral suitable for functioning as a densifying agent such that upon forming a complex with contaminants in a paper making process, the resulting complex has a sufficiently higher density than the paper fibers that a separation can be feasibly conducted. In preferred embodiments, the mineral has a density of at least about 1.5 g/ml, more preferably at least about 2.0 g/ml and more preferably at least about 2.5 g/ml. A second functional requirement of the mineral of the present invention is that it be capable of being associated with a cationic material. For example, as described in more detail below, talc has anionic edges that can be modified with a cationic polymer. For example, the mineral can be selected from talc, clay, kaolin, montmorillonite, bentonite, calcium carbonate, diatomaceous earth, saponite and wollastonite. In a preferred embodiment, the mineral is talc. As shown below in Table 1, talc has a very strong affinity (more negative AG values represent higher affinity) to adhesives, waxes, toner inks and hot melts and thereby readily attracts these materials in addition to attracting anionic materials when the talc is cationized.

**TABLE 1**

<table>
<thead>
<tr>
<th>Mineral</th>
<th>Adhesive</th>
<th>Wax</th>
<th>Toner Ink</th>
<th>Hot Melt</th>
</tr>
</thead>
<tbody>
<tr>
<td>Talc</td>
<td>-34.33</td>
<td>-42.66</td>
<td>-30.05</td>
<td>-23.40</td>
</tr>
<tr>
<td>Ground CaCO₃</td>
<td>9.28</td>
<td>3.16</td>
<td>1.87</td>
<td>20.73</td>
</tr>
<tr>
<td>Bentonite</td>
<td>-4.95</td>
<td>-9.83</td>
<td>-7.96</td>
<td>2.93</td>
</tr>
</tbody>
</table>


Without limitation, portions of the remaining description will be discussed in terms of the preferred embodiment of talc. Pure talc refers to a hydrous magnesium silicate having a theoretical molecular composition of 3MgO·4SiO₂·H₂O. It is composed of three layers: a magnesium oxide or brucite layer sandwiched between two silica layers. Unlike other layered silicate minerals such as clay, the three layers in a talc crystal are in perfect electrical balance resulting in a mineral that carries little or no electrical charge. This lack of charge makes talc a nonpolar or hydrophobic mineral that prefers to attach itself to other hydrophobic materials such as stickies and wood pitch. This explains why talc is widely used as a pitch/sticky control agent. The edges of talc are anionic which can be modified (e.g., cationized) to increase its effectiveness in controlling anionically-charged stickies.

The step of imparting a cationic charge to the surface of the mineral particles such as talc, for example, can
be accomplished by mixing the talc particles with water to create a slurry and, adding a cationic compound to the slurry. Cationized particles and the production thereof are described, for example, in U.S. Pat. No. 4,964,955, which is incorporated herein by reference in its entirety. The cationic compound can be any suitable cationic compound and in particular, can be a cationic polymer (such as polyamines, polyacrylamides and polyadamaes), cationic wet-end starch, cationic wax-based emulsion, carboxymethylcellulose and mixtures or blends thereof.

[0020] Talc used as a mineral in the present invention can be processed as part of the present invention by any suitable method. For example, one such method is by milling talc with an air classified mill (“ACM”). Here, the talc is dry and ishammered to achieve a desired particle size distribution curve. The talc particles are then screened to the desired median particle size. The ACM process produces more fractured talc particles than delaminated talc particles. Another talc milling method is a fluidized energy method (“FEM”). Here, the talc is mixed into a slurry with water such that the talc is held in suspension and the talc particles are sorted to achieve the right particle size distribution curve.

[0021] Talc used in the present invention preferably has a median particle size greater than about 2 microns in diameter. More preferably, the talc size is greater than about 4 microns in diameter. Even more preferably, the talc size is greater than about 5 microns in diameter.

[0022] Talc has a very good affinity for pressure sensitive adhesives, hot melts and waxes due to talc’s inherent hydrophobicity. The affinity of talc for these compounds is better than those of other minerals and compounds that are common to the paper industry, such as bentonite, clay, calcium carbonate and diatomaceous earth. It should be recognized, however, that any of these compounds can be used in the method of the present invention. Because the talc is naturally attracted to the adhesives, melts and waxes, the talc will bind, adhere, absorb, or interact through charge attraction to the adhesive, melt or wax and will form talc and contaminant complexes.

[0023] The cationized mineral can be added to the slurry at atmospheric conditions, at ambient or higher temperatures and at any pH of the slurry. The cationized mineral is added to the slurry in an amount ranging from about 5 pounds to about 40 pounds cationized mineral per pound of bone-dry fiber. More preferably, cationized mineral is added to the slurry in an amount ranging from about 10 pounds to about 30 pounds cationized mineral per pound of bone-dry fiber; even more preferably, in an amount ranging from about 15 pounds to about 25 pounds of cationized mineral per pound of bone-dry fiber.

[0024] Once the talc is added to the slurry, the slurry can be mixed in order to distribute the cationized mineral throughout the slurry. However, such a mixing step is optional. The slurry is then sent to a separator to separate the paper fibers from the cationized mineral/contaminant complexes. The separation is effected at the centrificlears or hydrocyclones. Centrifugal cleaners are used to separate particles of different densities while these particles are suspended in an aqueous medium. Centrifugal cleaners operate on the principle that, when a continuous centrifugal force is applied inside a cone, heavier particles will settle down to the tip of the cone and can be eventually removed from the cone in an “under” stream while the lighter particles in the aqueous medium will float and can be removed from the cone in an “upper” stream. The paper industry uses centrifugal cleaners in various ways to remove contaminants present in a cellulosic fiber slurry. While these centrifugal cleaners work well with particles having different densities, as the densities of the contaminants approach 1.0 g/ml (the density of water), the centrifugal cleaners cannot remove the contaminants. Among such contaminants are waxes, pressure sensitive adhesives and hot melts. Additionally, the specific gravity of the pulp fiber is close to 1.0, making the removal of the contaminants especially difficult. The density of talc, for example, is approximately 2.7 g/ml, making it easily separable through density and size separations, from the pulp fibers and water.

[0025] Without intending to be bound by theory, the present invention is believed to work by forming complexes between contaminants such as adhesives, hot melts and waxes and the higher density cationized mineral. Since the density of the contaminants is too similar to the water and paper fiber for an effective separation, the density of the contaminants needs to be effectively increased or decreased in order to make the density of the contaminants different enough from the density of the aqueous medium and the fibers. It has been found that the addition of a cationized mineral to the fiber slurry densifies the contaminants enough in order to allow the contaminants to be removed via a centrifugal separator. While not wishing to be bound by any theory, it is believed that the cationized mineral binds to the contaminants and, by binding with the contaminants, creates a new complex with an increased density than that of the contaminants. Thus, because the cationized mineral has increased the density of the waxes and other contaminants, the densified waxes and other contaminants can be separated from the paper fiber slurry. The separation may also be effective due to a change in size of the contaminants versus the cationized mineral/contaminant complexes.

[0026] The present invention provides a number of benefits compared to other known systems of removing contaminants during the processing of recycled paper fibers. The present process effectively removes a wide variety of contaminants. In addition, the use of a cationized mineral, such as cationized talc, is simple to use, and does not require control over the temperature, pH control and pulp consistency during the process.

**EXAMPLES**

[0027] In the example that follows, both conventional and cationized talc of different particle sizes were used. For the purposes of these studies, talc was cationized with the addition of a polyamine.

[0028] A Krebs Engineers Uniclude was used as the centrifugal separator or cleaner for the purposes of the examples. An OCC paper pulp slurry was obtained from a paper mill. Example 1

**Example 1**

[0029] Forty-nine liters of an OCC paper pulp slurry, with waxes and other contaminants present in the slurry, was obtained from a paper mill. The slurry had a starting pH of about 4.8, a Mutek charge of negative 100 microequivalents
per liter, and a solids content (or consistency) of about 0.42%. The slurry was divided into two equal parts of 24 liters. The first part was used as the control, while the second part was treated with cationized talc at 1.0% of the weight of the dry pulp fibers.

The slurries were both heated, while stirred, to approximately 42 degrees Celsius and passed once through a Krebs Uniclonc. The first slurry was stirred and heated for approximately 30 minutes. The second slurry was stirred and heated for approximately 30 minutes, the cationized talc was then added, and the slurry with the talc was heated and stirred for another 30 minutes.

The rejects of the first pass were then used as feedstock for a second pass through the Uniclonc. The rejects of the second pass were then used as feedstock for a third pass. The accepts of all three passes with added together. The rejects in the following table represent the rejects following the third pass. The feed flow rate and pressure differential rate of 25 psi were kept constant throughout all three passes in the hydrocyclone. The results of the passes through the hydrocyclone are contained in Table 2.

<table>
<thead>
<tr>
<th>Hydrocyclone Results</th>
<th>Volume Collected, mL</th>
<th>Consistency, %</th>
<th>Bone-dry Weight, g</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>W/o talc</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Accepts</td>
<td>21500</td>
<td>0.37</td>
<td>79.55</td>
</tr>
<tr>
<td>Rejects</td>
<td>2500</td>
<td>0.83</td>
<td>20.75</td>
</tr>
<tr>
<td>With cationized talc</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Accepts</td>
<td>21250</td>
<td>0.35</td>
<td>74.4</td>
</tr>
<tr>
<td>Rejects</td>
<td>2750</td>
<td>0.98</td>
<td>26.95</td>
</tr>
</tbody>
</table>

The results show that more rejects were in the second slurry, the slurry treated with talc. Additionally, the rejects had a higher weight due to the higher consistency of the rejects from the passes through the hydrocyclone.

The accepts/rejects of the two slurries were then further analyzed to determine pH, Mutel charge and conductivity. The results of this analysis is contained in Table 3.

<table>
<thead>
<tr>
<th>pH, Mutel Charge and Conductivity Results</th>
<th>Mutel Charge, Microeq/L</th>
<th>Conductivity, microS</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Without talc</td>
<td>4.78</td>
<td>1400</td>
</tr>
<tr>
<td>Rejects</td>
<td>4.83</td>
<td>1460</td>
</tr>
<tr>
<td>With cationized talc</td>
<td>4.84</td>
<td>1410</td>
</tr>
<tr>
<td>Rejects</td>
<td>4.84</td>
<td>1470</td>
</tr>
</tbody>
</table>

As expected, no significant differences between the two slurries was shown. The next step was to analyze whether more contaminants were removed by the talc treated slurry. To do this, a Pulmac classification test, a size separation of the rejects, was performed on the rejects of each of the two slurries using a 6-cut screen. The rejects from the Pulmac classification, i.e., the items left on the bottom of the screen or the top of a pad, were separately. A blue colored bond paper was placed on top of the pad to sandwich the rejects between the pad and the bond paper and run through a heated drum. The heat transferred the rejects (especially stickies and contaminants) to the blue-colored bond paper. The transferred items were then counted manually and classified by microscope and visual observation into wax or non-wax categories. The results of the microscope classification are contained in Table 4.

### TABLE 4

<table>
<thead>
<tr>
<th>Total and Wax Contaminants</th>
<th>Total Contaminants</th>
<th>Wax Contaminants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Without talc</td>
<td>26</td>
<td>20</td>
</tr>
<tr>
<td>With cationized talc</td>
<td>55</td>
<td>48</td>
</tr>
</tbody>
</table>

The above results clearly show the significant improvement in removal of wax and other contaminants in the lower stream of the hydrocyclone.

The above results show the significant improvement in removal of wax and other contaminants in the lower stream of the hydrocyclone.

**FIG. 2** shows an embodiment of a chemical process that embodies the principles of the method of the present invention. In this embodiment, pulp fibers and water are added to a mixing tank 10 and slurred. The slurry is then poured over a sieve or screen 20 and the coarse contaminants are held on the top surface of the screen while the remainder of the slurry passes to a second mixing tank 30. While the slurry is in the second mixing tank 30, talc is added to the slurry. The slurry is then transferred to a cyclone separator or cleaner 40. The separator 40 separates the slurry into two process streams, an “upper” stream 60 which contains the paper pulp fibers to be used in the remainder of the paper process and a “lower” stream 50 which contains the talc and contaminants that have to be removed. One skilled in the art can envision many different processes other than one depicted that would embody the principles of and accomplish the goals of the present invention. For example, only one mixing tank could be used, more than one centrifugal cleaner could be used, or more than one screen or sieve could be used. Each and every such embodiment is within the scope of the invention.

**Example 2**

**Mill Trial Results, Mill A**

The above results clearly show the significant improvement in removal of wax and other contaminants in the lower stream of the hydrocyclone.

Table 5 shows the results obtained in a mill trial. Two talcs were used and a 5-stage centricleaneer set-up as shown in FIG. 3. Clearly, talc was able to densify the stickies and helped effect their removal as indicated by the “rejects” and the “macrostickies reduction”.

### TABLE 5

<table>
<thead>
<tr>
<th>Sticky area (% of Inlet), mm²/m²</th>
<th>Inlets</th>
<th>Accepts</th>
<th>Rejects</th>
<th>Macrostickiesa</th>
</tr>
</thead>
<tbody>
<tr>
<td>No talc</td>
<td>100</td>
<td>89</td>
<td>202</td>
<td>11</td>
</tr>
<tr>
<td>Cationized Talc A</td>
<td>100</td>
<td>37</td>
<td>570</td>
<td>&gt;50</td>
</tr>
<tr>
<td>Cationized Talc B</td>
<td>100</td>
<td>46</td>
<td>429</td>
<td>&gt;50</td>
</tr>
</tbody>
</table>

*Greater than 150 µm in size

The rejects were enriched by more than twice to almost threefold with Tales A and B. Additionally, the macrostickies were enhanced by more than 4 times.
Example 3

Mill Trial Results, Mill B (Deink Pulp in LWC)

[0039] Cationic talc with a median particle size of 3.6 μm at 2.6% dosage was added to a chest at 1% consistency before the Cellecto forward cleaners in the deinking line of a lightweight coated (LWC) mill and allowed to mix with the fibers for about 10 minutes. The inlet, accept, and reject streams at the 1st stage cleaners were sampled and sticky content was measured using 150 μm screens. The results are shown in Table 6.

<table>
<thead>
<tr>
<th>TABLE 6</th>
<th>Stickies (&gt;150 μm), mm²/m² (1st stage cleaners)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Inlet</td>
</tr>
<tr>
<td>Area</td>
<td>Area</td>
</tr>
<tr>
<td>Without talc</td>
<td>1544</td>
</tr>
<tr>
<td>With cationized talc</td>
<td>955</td>
</tr>
</tbody>
</table>

[0040] With no cationized talc added, there was no reduction in stickies between inlet and accepts, but with cationized talc the stickies in the accepts were reduced by 63% which is significant. With cationized talc, the pulp accepts were cleaner which should help the papermakers improve machine runnability and product quality.

[0041] The principles, preferred embodiments and modes of operation of the present invention have been described in the foregoing specification. The invention which is intended to be protected herein should not, however, be construed as limited to the particular forms disclosed, as these are to be regarded as illustrative rather than restrictive. Variations and changes may be made by those skilled in the art without departing from the spirit of the present invention. Accordingly, the foregoing best mode of carrying out the invention should be considered exemplary in nature and not as limiting to the scope and spirit of the invention as set forth in the appended claims.

We claim:

1. A method of removing contaminants from a recycled paper fiber slurry, comprising:
   - adding a cationized mineral to the paper fiber slurry to form cationized mineral/contaminant complexes;
   - separating the cationized mineral/contaminant complexes from the paper fiber in the paper fiber slurry.

2. The method of claim 1, wherein the step of separating comprises a process selected from the group consisting of size separation and density separation.

3. The method of claim 1, wherein the step of separating comprises subjecting the paper fiber slurry and cationized mineral/contaminant complexes to a centrifugal separator to produce a first product stream comprising paper fibers and a first reject stream comprising cationized mineral/contaminant complexes.

4. The method of claim 3, further comprising (i) subjecting the first reject stream to a centrifugal separator to produce a second product stream comprising paper fibers and a second reject stream comprising cationized mineral/contaminant complexes; and (ii) combining the first and second product streams.

5. The method claim 1, wherein the cationized mineral is formed by a process comprising adding a cationic compound to the mineral.

6. The method claim 5, wherein the cationic compound is selected from the group consisting of a cationic polymer, cationic wet-end starch, cationic wax-based emulsion, carboxymethylcellulose and mixtures thereof.

7. The method claim 6, wherein the cationic compound is a cationic polymers selected from the group consisting of polyanime, polydadmac, polyacrylamide and mixtures thereof.

8. The method claim 1, further comprising screening the slurry to remove coarse contaminants before the step of adding cationized mineral to the paper fiber slurry.

9. The method claim 1, wherein the mineral is selected from the group consisting of talc, clay, kaolin, montmorillonite, bentonite, calcium carbonate, diatomaceous earth, saponite and wollastonite.

10. The method claim 1, wherein the mineral is talc.

11. The method claim 1, wherein the cationized mineral is added to the paper fiber slurry in an amount between about 5 pounds to about 40 pounds of cationized mineral per pound of paper fiber.

12. A method of removing contaminants from a recycled paper fiber slurry, comprising:
   - adding a cationized talc to the paper fiber slurry to form cationized talc/contaminant complexes;
   - separating the cationized talc/contaminant complexes from the paper fiber in the paper fiber slurry based on differences in density between the paper fiber and the cationized talc/contaminant complexes.

13. The method claim 12, wherein the cationic compound is selected from the group consisting of a cationic polymer, cationic wet-end starch, cationic wax-based emulsion, carboxymethylcellulose and mixtures thereof.

14. The method claim 13, wherein the cationic compound is a cationic polymer selected from the group consisting of polyanime, polydadmac, polyacrylamide and mixtures thereof.

15. The method claim 12, wherein the talc has a median particle size of greater than about 2 microns.

16. The method claim 12, wherein the cationized talc is added to the paper fiber slurry in an amount between about 5 pounds to about 40 pounds of cationized talc per pound of paper fiber.

17. A method of removing contaminants from a recycled paper fiber slurry, comprising:
   - adding a cationized talc to the paper fiber slurry to form cationized talc/contaminant complexes, wherein the talc has a median particle size of greater than about 2 microns, and wherein the cationic compound is a cationic polymer selected from the group consisting of polyanime, polydadmac, polyacrylamide and mixtures thereof;
   - separating the cationized talc/contaminant complexes from the paper fiber in the paper fiber slurry in a centrifugal separator.

18. The method claim 17, wherein the cationized talc is added to the paper fiber slurry in an amount between about 5 pounds to about 40 pounds of cationized talc per pound of paper fiber.

* * * * *