SYNTHETIC RESIN COMPOSITION FOR PVC NONTOXIC WINDOWS, AND NONTOXIC PVC WINDOWS

Abstract: The present invention relates to a synthetic resin composition for Nontoxic PVC windows that exhibits excellences in initial coloration, thermal resistance, and weather resistance without containing lead (Pb) or cadmium (Cd) based stabilizers harmful to the human body, and Nontoxic PVC windows. More specifically, the present invention provides a synthetic resin composition for nontoxic PVC windows as a stabilizer composition that includes (a) a nontoxic metal-soap based stabilizer, and (b) a nontoxic metal based inorganic stabilizer; and a nontoxic PVC window obtained using the synthetic resin composition by kneading and extrusion.\[Continued on next page\]

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Description

Title of Invention: SYNTHETIC RESIN COMPOSITION FOR PVC NONTOXIC WINDOWS, AND NONTOXIC PVC WINDOWS

Technical Field

[1] The present invention relates to a synthetic resin composition for Nontoxic PVC windows; that exhibits excellences in initial coloration, thermal resistance, and weather resistance without containing lead (Pb) or cadmium (Cd) based stabilizers harmful to the human body, and Nontoxic PVC windows.

Background Art

[2] The PVC windows are being used in many building structures as a material for living constructions shown in everyday life. However, polyvinyl chloride (PVC) contains a large quantity of chloride group, which is prone to departure, leaving its position becoming a radical and then immediately a double bond. Such an increase in the quantity of the double bonds causes discoloration of PVC and progresses abruptly with an increasing temperature to turn the PVC to red and black for worse.

[3] Such a low thermal resistance requires the addition of a stabilizer having an effect of compensating for the low thermal resistance in order to enable the processing and molding of PVC.

[4] The existing PVC windows commercially available are mostly manufactured by adding a lead (Pb) based stabilizer containing lead (Pb) or cadmium (Cd) which is strongly toxic. Lead (Pb) or cadmium (Cd) does not only do harm to the human body but has a long half-life that it can remain in the human body throughout the life to cause toxic symptoms. It is therefore necessary to use a stabilizer prepared from a material only harmless to the human body, but there have been many limitations in using nontoxic stabilizers because of the technical problems and others regarding quality and cost.

[5] The present invention is to solve the problem regarding the use of stabilizers and to fabricate nontoxic PVC windows not containing toxic substances, such as lead (Pb) or cadmium (Cd).

[6] The PVC windows containing lead (Pb) or cadmium (Cd) are harmful to the workers in their manufacture and emit the internal toxic stabilizer by friction or wear even after installed in a building structure, possibly having a seriously adverse effect on the human body. For that reason, many advanced countries in Europe and the United States have already enacted the use of nontoxic stabilizers and developed many technologies concerning the nontoxic materials. It is however not easy to replace the lead...
(Pb) based stabilizers with nontoxic stabilizers in regard to high performance, because lead (Pb) or cadmium (Cd) has excellences in thermal stability, processability, or weather resistance. In other words, the enhanced thermal resistance leads to deterioration of the processability, and balancing the processability with the thermal resistance causes problems in the weather resistance. Using an excess of an organic stabilizer in order to satisfy all of the properties can cause another problem regarding the properties or a rise of the cost, so it is practically difficult to manufacture PVC windows using a nontoxic stabilizer.

The PVC windows can use metal-soap based stabilizers or tin (Sn) based stabilizers. But, the tin (Sn) based stabilizers of some types have problems in use, such as having an adverse effect regarding the environmental hormones or emitting a foul odor during the work, resulting in a controversy raised over the nontoxicity of the tin (Sn) based stabilizers which have been known to be harmless and still used, and thus leaving many problems in achieving complete nontoxicity. For the sake of manufacturing completely nontoxic windows, many studies have been made to develop an approach of using a nontoxic metal-soap based stabilizer containing a fatty acid having a C₃₋C₅₀ alkyl group bonded to a nontoxic metal (e.g., Ca, Mg, Zn, etc.) as a major stabilizer in combination with any kind of internal/external lubricants under control. But, the use of the metal-soap based stabilizers has an insufficient effect to overcome the problems in regard to processability and weather resistance and provides unsatisfactory results in the thermal resistance or the initial coloration. Thus, many studies have been made to solve these problems.

In particular, EP1088032 discloses a stabilizer composition containing calcium acetylacetonate and tris-hydroxy ethyl iso-cyanurate (THEIC) added as organic stabilizers to aid the metal-soap stabilizer and enhance the thermal resistance, and using calcium hydroxide added as an inorganic stabilizer. EP16 13696 describes a stabilizer composition using zinc octoate as an organic stabilizer in combination with zinc stearate.

In addition, EP1692220 discloses a stabilizer composition containing zinc caprylate as an organic stabilizer in combination with zinc stearate to enhance the initial coloration and the thermal resistance. But, the use of such an organic stabilizer in polymers causes many problems in regard to plate-out, poor weather resistance, and economical disadvantages.

Thus, there is a demand for continuous studies on the techniques to solve all the problems concerning initial coloration, thermal resistance, weather resistance, and economical issue.

**Disclosure of Invention**
Technical Problem

From the studies made on the stabilizers used to solve the problems with the related art and enable a production of high-performance non-toxic PVC windows, the inventors of the present invention have found it out that a stabilizer composition which includes a nontoxic metal-soap based stabilizer containing a fatty acid having a \( \text{C}_3-\text{C}_{50} \) alkyl group bonded to a nontoxic metal (e.g., Ca, Mg, Zn, etc.) in combination with an nontoxic-metal based inorganic stabilizer can be used to solve all the problems with the related art without reducing the amount of the organic stabilizer or using the organic stabilizer, thereby completing the present invention.

It is therefore an object of the present invention to provide a synthetic resin composition for non-toxic windows as a synthetic resin composition for PVC windows.

It is another object of the present invention to provide a nontoxic PVC window using the above-mentioned synthetic resin composition for nontoxic windows and thus having excellences in initial coloration, thermal resistance, and weather resistance.

Solution to Problem

In accordance with the present invention, there is provided a synthetic resin composition for non-toxic PVC window that includes a stabilizer for the synthetic resin, which includes: (a) a nontoxic metal-soap based stabilizer; and (b) a nontoxic metal based inorganic stabilizer.

In accordance with the present invention, there is also provided a nontoxic PVC window being fabricated using the aforementioned synthetic resin composition for non-toxic PVC window by kneading and extrusion and having improved properties including thermal resistance, weather resistance, and prevention against initial coloration.

Hereinafter, a detailed description will be given as to the present invention.

Firstly, the synthetic resin composition for non-toxic PVC window according to the present invention features a specific stabilizer composition of the present invention.

In other words, the technical feature of the synthetic resin composition is a combination of (a) a nontoxic metal-soap based stabilizer and (b) a nontoxic metal based inorganic stabilizer, where the nontoxic metal-soap based stabilizer contains a fatty acid having a \( \text{C}_3-\text{C}_{50} \) alkyl group bonded to a nontoxic metal (e.g., Ca, Mg, Zn, etc.).

In the composition, the nontoxic metal-soap based stabilizer (a) may be a compound containing at least one metal selected from the group consisting of Li, Na, K, Mg, Ca, Al, and Zn substituted with hydrogen in a fatty acid having an alkyl group containing 3 to 50 carbon atoms. Under heat or other severe conditions, PVC is prone to chlorine...
departure to form a radical, which becomes a double bond, subsequently causing discoloration or ageing. Hence, the inactivation of free chlorines is a critical factor in enhancing the thermal resistance. In this regard, zinc stearate which is known as a representative nontoxic organic substance is quick to capture the free chlorines to provide excellence for the initial thermal resistance.

On the other hand, calcium stearate or magnesium stearate is slow to capture the free chlorine but effective to secure a long-term thermal resistance, since it becomes stable once the free chlorines are captured. Therefore, calcium stearate or magnesium stearate can be used as an alternative to zinc stearate.

The fatty acid may include any fatty acids either saturated or unsaturated, and linear or branched, or aromatic fatty acids.

The content of the nontoxic metal-soap based stabilizer is preferably in the range from 0.1 part by weight to 15 parts by weight with respect to 100 parts by weight of PVC. The content of the nontoxic metal-soap based stabilizer less than 0.1 part by weight results in the PVC carbonated without being melted in the PVC processing, while the content of the nontoxic metal-soap based stabilizer greater than 15 parts by weight leads to a failure in melting the PVC to retard the gelation time and thus deteriorate the processability, consequently with the difficulty of plate-out PVC dispersion.

The term "the nontoxic metal based inorganic stabilizer" as used herein refers to a compound used as a conventional inorganic stabilizer, such as metal oxide or hydroxide based inorganic substances, coated with at least one metal selected from the group consisting of Li, Na, K, Mg, Ca, Al, and Zn, or its compound. For example, the inorganic stabilizer may be coated with zinc (Zn), magnesium (Mg), calcium (Ca), or their compounds.

In this regard, the metal oxide or hydroxide based inorganic substances may include, but are not limited to, at least one selected from the group consisting of calcium oxide, calcium hydroxide, magnesium oxide, magnesium hydroxide, aluminum oxide, aluminum hydroxide, hydrotalcite, hydrocalumite, zeolite, magnesite, calcium phosphate, hunte, and titanium oxide.

The specific coating methods as used herein may include, but are not limited to, a coating method of using an aqueous solution of zinc (Zn), a coating method using electrolysis, a coating method using high-speed crushing and hot melting, and a physical method using crushing and friction.

The content of the nontoxic metal or nontoxic metal compound is preferably in the range from 0.01 part by weight to 10 parts by weight with respect to 100 parts by weight of the metal oxide or hydroxide inorganic substance, with a view of achieving an early capture of chlorine to enhance thermal resistance and prevent the initial
coloration.

[29] The content of the nontoxic metal based inorganic stabilizer (b) is preferably in the range from 0.5 part by weight to 15 parts by weight with respect to 100 parts by weight of PVC. As demonstrated in the following examples, an addition of the nontoxic metal based inorganic stabilizer within the above-defined content range causes no deformation by heat and provides the resin with excellent mechanical properties, including high thermal resistance, high dispersibility, resistance to coagulation, high impact strength.

[30] The composition of the present invention may further include 0.1 to 5 parts by weight of at least one auxiliary stabilizer (c) selected from the group consisting of 1,3-diketone, dihydro-pyridine, polyols, isocyanurate, amino acid derivatives, organic esters of phosphoric acid, epoxy compounds, perchlorate, and salts of superacids, with respect to 100 parts by weight of PVC. The content of the auxiliary stabilizer less than 0.1 part by weight gives an insignificant effect to secure the thermal stability of PVC, causing carbonation of the PVC, while the content of the auxiliary stabilizer greater than 5 parts by weight leads to coloration during the processing of PVC due to the use of an excess of the auxiliary stabilizer.

[31] The composition of the present invention may further include 0.01 to 5 parts by weight of at least one organic stabilizer (d) selected from the group consisting of zinc octoate, zinc caprylate, calcium acetylacetonate, and tris-hydroxy ethyl iso-cyanurate (THEIC), with respect to 100 parts by weight of PVC.

[32] The PVC used in the composition of the present invention may include, but is not limited to, at least one selected from the group consisting of copolymers of vinyl acetate and polyvinyl chloride, polyvinylidene chloride, chlorinated polyethylene, chlorosulfonated polyethylene, chlorinated polypropylene, or chlorinated ethylene.

[33] Preferably, the composition of the present invention may further include at least one selected from the group consisting of 0.5 to 10 parts by weight of a processing aid, 5 to 15 parts by weight of an impact modifier, 2 to 10 parts by weight of TiO₂, 10 to 30 parts by weight of calcium carbonate, 0.5 to 10 parts by weight of a lubricant, and 0.1 to 5 parts by weight of an antoxidizing/UV-blocking agent, with respect to 100 parts by weight of PVC.

[34] The processing aid may include at least one selected from the group consisting of acrylate-based processing aids, methacrylate-based processing aids, and acrylonitrile-based processing aids.

[35] Further, the impact modifier may include at least one selected from the group consisting of acryl-based impact modifiers and chlorinated polyethylene-based impact modifiers.

[36] Further, TiO₂ may be added to serve as a white pigment and supplement the weather
resistance of the window, and calcium carbonate may be used to enhance impact resistance.

Further, the lubricant may include at least one selected from the group consisting of montan wax, fatty acid esters, triglycerides or their partial esters, glycerin esters, polyethylene waxes, paraffin wax, metal-soap based lubricants, and amide based lubricants.

Further, the antioxidizing/UV-blocking agent may include at least one selected from the group consisting of primary and secondary antioxidizing agents and HALS-based UV stabilizers. More specifically, the antioxidizing/UV-blocking agent may include at least one selected from the group consisting of 2,6-di-tert-butyl-4-methylphenol, 2,6-di-benzyl-4-methylphenol, stearyl 3-(3,5-di-tert-butyl-4'-hydroxylphenyl)propionate, 4,4'-thiobis-(3-methyl-6-tert-butylphenol), 4-nonylphenol, 2,2'-methylene bis(4-methyl-6-tert-butylphenol), 2,5-di-tert-butyl-hydroquinone, and 4,4',4"-(1-methyl-l-propanyl-3-ylidene)-tris-2-(l,l-dimethylethyl)-5-methylphenol.

Besides, the composition may further include other inorganic fillers, dyes, pigments, anti-static agents, surface-treatment agents, foaming agents, impact reinforcing agents, and so forth.

Advantageously, the synthetic resin composition does not include toxic substances, such as lead (Pb) or cadmium (Cd), which have been used as a conventional stabilizer. The composition is subjected to kneading and extrusion to produce nontoxic PVC windows improved in properties, such as thermal resistance, weather resistance, and prevention of initial coloration.

**Advantageous Effects**

As described above, the present invention can improve the initial coloration and enhance the medium- or long-term thermal resistance of PVC.

Hence, the PVC windows of the present invention have excellences in both chlorine resistance and thermal resistance and practically feature good weather resistance enhanced by the use of inorganic stabilizers. Further, the PVC windows of the present invention uses an appropriate combination of at least two different inorganic stabilizers which differ in characteristics and cost to acquire the advantage in the aspect of the cost, so they can be a substitute for the PVC windows using lead (Pb) or cadmium (Cd) stabilizers.

**Brief Description of Drawings**

FIG. 1 presents photographs showing the lead check results of Example 1 of the
present invention and Comparative Example 2 as the prior art.

**Mode for the Invention**

Hereinafter, a detailed description will be given as to the present invention by way of the following example. The example of the present invention is susceptible to many changes and modifications and should not be construed to limit the scope of the present invention.

In the following examples, the processing aid is a methacrylic acid methyl ester-butyl-2-propene acid-ethyl benzene polymer; the impact modifier is chlorinated polyethylene; the lubricant is 1,2-benzene dicarboxylic acid dialkyl ester; the nontoxic metal-soap based compound is zinc stearate or calcium stearate; the organic stabilizer is tris-hydroxyethyl iso-cyanurate; the antioxidizing/UV-blocking agent is tetrakis-methylene methanone or tris-phosphate; the metal oxide or hydroxide based inorganic substance is sodium aluminum silicate, or hydrotalcite; and the auxiliary stabilizer is dibenzoyl methane metal mixture.

<Example>

**Example 1**

To make a good quality homogeneous mixture, a Henschel mixer is used at a high speed at 110°C for 10 minutes to mix 100 parts by weight of PVC, 1 part by weight of a processing aid, 8 parts by weight of an impact modifier, 4 parts by weight of TiO₂, 12 parts by weight of calcium carbonate, 0.5 part by weight of a lubricant, 2 parts by weight of a nontoxic metal-soap based stabilizer, 0.2 part by weight of an organic stabilizer, 0.1 part by weight of an antioxidizing/UV-blocking agent, 1 part by weight of a nontoxic metal based inorganic stabilizer (i.e., a stabilizer prepared by coating 100 parts by weight of a metal oxide or hydroxide based inorganic substance with 10 parts by weight of zinc), and 0.2 part by weight of an auxiliary agent. The mixture thus obtained is then extruded into a window profile through a PVC window extruder (L/D 25:1, screw type parallel 90 mm) under the extruder conditions as defined below.

**Table 1**

<table>
<thead>
<tr>
<th>Temp. of cylinder 1 (°C)</th>
<th>Temp. of cylinder 2 (°C)</th>
<th>Temp. of cylinder 3 (°C)</th>
<th>Temp. of adaptor (°C)</th>
<th>Temp. of die (°C)</th>
<th>rpm</th>
<th>Take-up speed (m/min)</th>
<th>Temp. of cooling water (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>180</td>
<td>175</td>
<td>170</td>
<td>165</td>
<td>190</td>
<td>10</td>
<td>2.0</td>
<td>15</td>
</tr>
</tbody>
</table>

**Comparative Example 1**

The procedures are performed to fabricate a window profile in the same manner as described in Example 1, excepting that a metal oxide or hydroxide based inorganic substance not coated with zinc or a zinc compound is used in place of an inorganic...
stabilizer which is a metal oxide or hydroxide based inorganic substance coated with zinc or a zinc compound.

[56] **Comparative Example 2**

The procedures are performed to fabricate a window profile in the same manner as described in Example 1, except for using 100 parts by weight of PVC, 1 part by weight of a processing aid, 8 parts by weight of an impact modifier, 4 parts by weight of TiO₂, 12 parts by weight of calcium carbonate, 0.5 part by weight of a lubricant, 2 parts by weight of a nontoxic metal-soap based stabilizer, and 3 parts by weight of a lead stabilizer.

[58] **Experiment Example 1: Impact Strength**

The impact strength testing is conducted according to the KS M 3056 method using a type I test specimen under present conditions at the standard temperature (23±2°C) and at low temperature (-10±1°C) each for 24 hours or longer. According to the KS F 5602 standards, the test specimen is up to the standard when the impact strength is 12.7 kJ/m² or greater at the standard temperature and 4.9 kJ/m² or greater at low temperature. The measurement results are presented in Table 2.

[60] **Experiment Example 2: Tensile Yield Strength and Tensile Strength at Break**

A testing to determine the tensile yield strength and the tensile strength at break is conducted according to the KS M 3006 method using a type II test specimen at the standard temperature (23±2°C). According to the KS F 5602 standards, the test specimen is up to the standard when it has a tensile yield strength of 36.8 MN/m² or greater and a tensile strength at break of 100% or greater. The measurement results are presented in Table 2.

[62] **Experiment Example 3: Hardness**

The hardness testing is conducted according to the scale R of the KS M ISO 2039-2 method. According to the KS F 5602 standards, the test specimen is up to the standard when its hardness is 85 or greater. The measurement results are presented in Table 2.

[64] **Experiment Example 4: Vicat Softening Temperature**

The vicat softening temperature testing is conducted under a load of 9.80 N according to the KS M 3076 method. According to the KS F 5602 standards, the test specimen is up to the standard when its vicat softening temperature is 83°C or above. The measurement results are presented in Table 2.

[66] **Experiment Example 5: Weather Resistance**

The weather resistance testing is done according to the KS F 2274 method to conduct a 1,000-hour exposure to xenon-arc radiations with a xenon-arc type apparatus, where the black panel temperature is 63±3°C, and the spray cycle is 18 minutes out of 120 minutes. Subsequently, the change of chrominance is measured with a colorimeter. According to the KS F 5602 standards, the test sample is up to the standard when it has
no noticeable discoloration. The measurement results are presented in Table 2.

**Experiment Example 6: Initial Coloration**

The chrominance value is determined with a colorimeter CR-400 in order to check on the appearance of the initial coloration. Further, the thermal resistance is determined by placing the sample specimen by 20 mm every 5 minutes at 200°C in a mathis oven. The measurement results are presented in Table 2.

**Experiment Example 7: Nontoxicity**

A lead test is carried out using a lead check swab to determine the presence of the lead component. The lead check swab that turns red proves the presence of lead, while the lead check that does not turn red means that there is not lead. As can be seen from FIG. 1, the lead check on the Example 1 shows no change of color, demonstrating no detection of lead. In contrast, the Comparative Example 2 using a lead stabilizer causes the test solution turned red to show that it contains lead.

**Table 2**

<table>
<thead>
<tr>
<th>Test items</th>
<th>Example 1</th>
<th>Comparative Example 1</th>
<th>Comparative Example 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impact strength (kJ/m²)</td>
<td>23.6</td>
<td>22.6</td>
<td>23.5</td>
</tr>
<tr>
<td>Standard temp. (23±2°C)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low temp. (-10±1°C)</td>
<td>8.4</td>
<td>7.8</td>
<td>8.5</td>
</tr>
<tr>
<td>Tensile yield strength (MN/m²)</td>
<td>40.56</td>
<td>41.41</td>
<td>39.35</td>
</tr>
<tr>
<td>Tensile strength/Elongation at break (%)</td>
<td>197.3</td>
<td>180.8</td>
<td>184.9</td>
</tr>
<tr>
<td>Hardness (HRR)</td>
<td>105.7</td>
<td>106.0</td>
<td>105.3</td>
</tr>
<tr>
<td>Vicat softening temperature (°C)</td>
<td>95</td>
<td>94</td>
<td>94</td>
</tr>
<tr>
<td>Weather resistance ΔE</td>
<td>1.11</td>
<td>1.12</td>
<td>1.09</td>
</tr>
<tr>
<td>Initial coloration Initial (L/a/b)</td>
<td>93.50/</td>
<td>92.95/</td>
<td>93.45/</td>
</tr>
<tr>
<td>-0.60/</td>
<td>-0.39/</td>
<td>-0.66/</td>
<td></td>
</tr>
<tr>
<td>2.47</td>
<td>2.69</td>
<td>2.45</td>
<td></td>
</tr>
<tr>
<td>ΔE after 20 min</td>
<td>2.74</td>
<td>2.89</td>
<td>3.35</td>
</tr>
<tr>
<td>ΔE after 40 min</td>
<td>9.16</td>
<td>10.60</td>
<td>11.43</td>
</tr>
<tr>
<td>Nontoxicity</td>
<td>Nontoxic</td>
<td>Nontoxic</td>
<td>Lead detected</td>
</tr>
</tbody>
</table>

The initial coloration is represented by the initial value of the extruded product. Further, a mathis oven is used to evaluate the thermal resistance. The difference of color after 20 minutes and 40 minutes is given by ΔE in contrast to the initial color value. The test shows that the Example 1 has an insignificant difference of color, showing high thermal resistance in relation to the Comparative Example 1.

The nontoxicity is evaluated through a lead check test to determine the presence of lead.
The nontoxic window is proven having none of lead, cadmium, and mercury in the detection accomplished by an outside institute, KCL. But, the outside institute does not evaluate the conventional windows using lead. Thus, the presence of lead is determined as shown in the pictures (FIG. 1) using a lead check swab.

As can be seen from the results of Table 2, all the testing results show that the window of the present invention meets the KS F 5602 standards and also proven as being excellent in regard to prevention of initial coloration and nontoxicity.
Claims

[Claim 1] A synthetic resin composition for nontoxic PVC window, comprising a stabilizer for the synthetic resin, the stabilizer comprising: (a) a nontoxic metal-soap based stabilizer; and (b) a nontoxic metal based inorganic stabilizer.

[Claim 2] The synthetic resin composition for nontoxic PVC window as claimed in claim 1, wherein the nontoxic metal-soap based stabilizer (a) is a compound containing at least one metal selected from the group consisting of Li, Na, K, Mg, Ca, Al, and Zn substituted with hydrogen in a fatty acid having an alkyl group containing 3 to 50 carbon atoms, wherein the synthetic resin composition contains 0.1 to 15 parts by weight of the nontoxic metal-soap based stabilizer with respect to 100 parts by weight of PVC.

[Claim 3] The synthetic resin composition for nontoxic PVC window as claimed in claim 1, wherein the nontoxic metal based inorganic stabilizer (b) is a compound comprising a metal oxide coated with at least one metal selected from the group consisting of Li, Na, K, Mg, Ca, Al, and Zn, wherein the synthetic resin composition contains 0.5 to 15 parts by weight of the nontoxic metal based inorganic stabilizer with respect to 100 parts by weight of PVC.

[Claim 4] The synthetic resin composition for nontoxic PVC window as claimed in claim 3, wherein the metal oxide comprises at least one selected from the group consisting of calcium oxide, magnesium oxide, aluminum oxide, aluminum hydroxide, and titanium oxide.

[Claim 5] The synthetic resin composition for nontoxic PVC window as claimed in claim 3, wherein the synthetic resin composition contains 0.01 to 10 parts by weight of the nontoxic metal with respect to 100 parts by weight of the metal oxide.

[Claim 6] The synthetic resin composition for nontoxic PVC window as claimed in claim 1, wherein the nontoxic metal based inorganic stabilizer (b) is a compound comprising a hydroxide based inorganic substance coated with at least one metal selected from the group consisting of Li, Na, K, Mg, Ca, Al, and Zn, wherein the synthetic resin composition contains 0.5 to 15 parts by weight of the nontoxic metal based inorganic stabilizer with respect to 100 parts by weight of PVC.

[Claim 7] The synthetic resin composition for nontoxic PVC window as claimed in claim 6, wherein the hydroxide based inorganic substance comprises
at least one selected from the group consisting of calcium hydroxide, magnesium hydroxide, aluminum hydroxide, hydrotalcite, hydrocalumite, zeolite, magnesite, calcium phosphate, huntite, and titanium oxide.

[Claim 8] The synthetic resin composition for nontoxic PVC window as claimed in claim 6, wherein the synthetic resin composition contains 0.01 to 10 parts by weight of the nontoxic metal with respect to 100 parts by weight of the hydroxide based inorganic substance.

[Claim 9] The synthetic resin composition for nontoxic PVC window as claimed in claim 1, wherein the composition further comprises 0.1 to 5 parts by weight of at least one auxiliary stabilizer with respect to 100 parts by weight, the at least one auxiliary stabilizer being selected from the group consisting of 1,3-diketone, dihydro-pyridine, polyl, isocyanurate, amino acid derivatives, organic esters of phosphoric acid, epoxy compounds, perchlorate, and salts of superacid.

[Claim 10] The synthetic resin composition for nontoxic PVC window as claimed in claim 1, wherein the composition further comprises 0.01 to 5 parts by weight of at least one organic stabilizer with respect to 100 parts by weight of PVC, the at least one organic stabilizer being selected from the group consisting of zinc octoate, zinc caprylate, calcium acetylactonate, and tris-hydroxy ethyl iso-cyanurate (THEIC).

[Claim 11] The synthetic resin composition for nontoxic PVC window as claimed in claim 1, wherein the PVC comprises at least one selected from the group consisting of copolymers of vinyl acetate and polyvinyl chloride, polyvinylidene chloride, chlorinated polyethylene, chlorosulfonated polyethylene, chlorinated polypropylene, or chlorinated ethylene.

[Claim 12] The synthetic resin composition for nontoxic PVC window as claimed in claim 1, wherein the composition further comprises at least one selected from the group consisting of 0.5 to 10 parts by weight of a processing aid, 5 to 15 parts by weight of an impact modifier, 2 to 10 parts by weight of TiO₂, 10 to 30 parts by weight of calcium carbonate, 0.5 to 10 parts by weight of a lubricant, and 0.1 to 5 parts by weight of an antioxidizing/UV-blocking agent, with respect to 100 parts by weight of PVC.

[Claim 13] The synthetic resin composition for nontoxic PVC window as claimed in claim 12, wherein the processing aid comprises at least one selected from the group consisting of acrylate-based processing aids, methacrylate-based processing aids, and acrylonitrile-based processing aids.
The synthetic resin composition for nontoxic PVC window as claimed in claim 12, wherein the impact modifier comprises at least one selected from the group consisting of acryl-based impact modifiers and chlorinated polyethylene-based impact modifiers.

The synthetic resin composition for nontoxic PVC window as claimed in claim 12, wherein the lubricant comprises at least one selected from the group consisting of montan wax, fatty acid esters, triglycerides or their partial esters, glycerin esters, polyethylene waxes, paraffin wax, metal-soap based lubricants, and amide based lubricants.

The synthetic resin composition for nontoxic PVC window as claimed in claim 12, wherein the antioxidizing/UV-blocking agent comprises at least one selected from the group consisting of 2,6-di-ter-butyl-4-methylphenol, 2,6-di-benzyl-4-methylphenol, stearyl 3-(3,5-di-tert-butyl-4′-hydroxylphenyl)propionate, 4,4’-thiobis-(3-methyl-6-tert-butylphenol), 4-nonylphenol, 2,2′-methylene bis(4-methyl-6-tert-butylphenol), 2,5-di-tert-butyl-hydroquinone, and 4,4′,4″-(1-methyl-1-propanyl-3-ylidene)-tris-2-(1,1-dimethylethyl)-5-methylphenol.

A nontoxic PVC window being fabricated using the synthetic resin composition for nontoxic PVC window as claimed in any one of claims 1 to 16 by kneading and extrusion and having improved properties including thermal resistance, weather resistance, and prevention against initial coloration.
A. CLASSIFICATION OF SUBJECT MATTER
C08L 27/06(2006.01)i, C08K 5/098(2006.01)i, C08K 3/22(2006.01)i, E06B 3/08(2006.01)i

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

B. FIELDS SEARCHED
Minimum documentation searched (classification system followed by classification symbols)
C08L 27/06; C08L 23/12; COIF 7/00; COIG 5/00; C08K 3/10; C08K 5/00; C08K 5/098; C08K 3/22; E06B 3/08

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Korean utility models and applications for utility models
Japanese utility models and applications for utility models

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
eKOMPASS(KIPO internal) & Keywords: PVC, stabilizer, inorganic

C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
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<tr>
<th>Category*</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
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<tr>
<td>X</td>
<td>KR 10-2010-0022455 A (D.H. LEE) 02 March 2010 See claims 1-7 and paragraphs [0016]-[0023].</td>
<td>1-2, 6-8, 12, 17</td>
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<td>KR 10-0969519 BI (TAEKANG I&amp;T CO., LTD.) 12 July 2010 See paragraphs [0039]-[0040] and [0046].</td>
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<td>A</td>
<td>KR 10-2009-0127199 A (SHIN WOUN CHEM. CO., LTD.) 10 December 2009 See the abstract and claims.</td>
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<tr>
<td>KR 10-2010-0022455 A</td>
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<td>27/04/2011</td>
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<td></td>
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