

DESCRIPTION

Title of Invention

RESIN COMPOSITION FOR CLEANING USE

Technical Field

[0001] The present invention relates to a resin composition for cleaning, to be used for cleaning the inside of an extruder or a shaping machine for a resin material.

Background Art

[0002] Various components, such as a resin and a colorant kneaded or shaped previously, are left inside an extruder or a shaping machine in some cases. When a thermoplastic resin is subjected to kneading or the like using an extruder or the like in which various components are left in this way, various residual components are liable to be mixed as impurities in a resultant product, such as a kneaded product or a shaped article, and there is a possibility that defects, such as abnormality in physical properties and defective appearance, occur. Accordingly, when products intended to be produced are switched, there has been a need for taking a measure, such as disassembling an apparatus, such as an extruder, to perform cleaning; replacing with a base material resin to be used next; cleaning with a detergent; or the like in order to remove the substances left inside.

[0003] However, in the case where an apparatus is disassembled to perform cleaning, there has been a problem that disassembling the apparatus takes great deal of labor, and therefore the cleaning requires time. In addition, in the case where replacement is performed with a base material resin to be used next, there have been problems that a large amount of the base material resin has to be used and it takes time to perform replacement sufficiently. Therefore, the method of cleaning the inside an extruder or the like with a detergent has generally been used.

[0004] As a related conventional technique, resin compositions for cleaning, which contains as a cleaning component an inorganic filler having a physical scraping effect, have been developed. For example, resin compositions for cleaning, containing an inorganic filler, such as glass fiber or zeolite, have been proposed (Patent Literatures 1 and 2).

[0005] Moreover, resin compositions for cleaning, in which the types and the like of resins and additives have been adjusted, have been developed. For example, a detergent for a shaping machine, which contains: two types of thermoplastic resins each having a different melt flow rate (MFR); and an inorganic foaming agent, has been proposed (Patent Literature 3). Further, a resin composition for cleaning, which contains: a thermoplastic resin; a borate ester salt of a higher fatty acid monoglyceride; and a fatty acid amide, has been proposed (Patent Literature 4).

Citation List

Patent Literature

[0006] Patent Literature 1: Japanese Patent Laid-Open No. 2008-201975

Patent Literature 2: Japanese Patent Laid-Open No. 7-278359

Patent Literature 3: Japanese Patent Laid-Open No. 2005-231108

Patent Literature 4: Japanese Patent Laid-Open No. 9-216976

Summary of Invention

Technical Problem

[0007] The resin compositions proposed in Patent Literatures 1 and 2 contain an inorganic filler having a scraping effect, and therefore the cleaning performance is satisfactory to a certain extent. However, there have been problems that the parts inside an apparatus are liable to be worn away, and the inorganic filler is liable to be left as an impurity. Further, with respect to the detergent and the resin composition proposed in Patent Literatures 3 and 4, the amount of the succeeding material resin needed for replacing and

removing the detergent or the like used for cleaning is large, and there has still been room for improvements in the cleaning performance.

[0008] The present invention has been accomplished in view of the problems of such conventional techniques, and an object of the present invention is to provide a resin composition for cleaning, which has excellent cleaning performance, can easily be replaced with a succeeding material resin, and is easy to handle.

Solution to Problem

[0009] The present inventors have conducted diligent studies in order to solve the problems to find that the problems can be solved by blending a thermoplastic resin having a melt flow rate of 1.0 g/10 min or less and an additive containing at least two of a metal soap, a fatty acid amide, and a mineral oil, and have thereby completed the present invention.

[0010] That is, according to the present invention, a resin composition for cleaning, described below, is provided.

[1] A resin composition for cleaning, to be used for cleaning an inside of an extruder or a shaping machine for a resin material, the resin composition for cleaning, containing: a base material resin; and an additive, wherein the additive contains: a metal soap; and at least any one of a fatty acid amide and a mineral oil, provided that when the additive comprises the fatty acid amide, the additive has a content of the fatty acid amide of 1.0% by mass or more based on a total mass of the resin composition for cleaning, and the base material resin is a thermoplastic resin having a melt flow rate of 1.0 g/10 min or less, provided that the thermoplastic resin having a content of an inorganic filler of 3 parts by mass or more based on 100 parts by mass of the thermoplastic resin is excluded.

[2] The resin composition for cleaning according to [1], wherein the thermoplastic resin has a melt flow rate of 0.6 g/10 min or less.

[3] The resin composition for cleaning according to [1] or [2], wherein the fatty acid amide has a melting point of 50 to 250°C.

[4] The resin composition for cleaning according to any one of [1] to [3], having a content of the metal soap of 0.5 to 6.0% by mass based on the total mass of the resin composition for cleaning.

[5] The resin composition for cleaning according to any one of [1] to [3], having a content of the metal soap of 1.5 to 5.0% by mass based on the total mass of the resin composition for cleaning.

[6] The resin composition for cleaning according to any one of [1] to [5], having a content of at least any one of the fatty acid amide and the mineral oil of 1.0 to 6.0% by mass based on the total mass of the resin composition for cleaning.

[7] The resin composition for cleaning according to any one of [1] to [5], having a content of at least any one of the fatty acid amide and the mineral oil of 1.5 to 5.0% by mass based on the total mass of the resin composition for cleaning.

Advantageous Effects of Invention

[0011] According to the present invention, a resin composition for cleaning, which has excellent cleaning performance, can easily be replaced with a succeeding material resin, and is easy to handle, can be provided. By using the resin composition for cleaning of the present invention, the cleaning time for cleaning an extruder and a shaping machine can be reduced, and the use amount of a succeeding material resin is small, so that waste can be reduced. In addition, the resin composition for cleaning of the present invention has a sufficient cleaning effect even when it is made into a composition substantially free of an inorganic filler. Therefore, when the resin composition for cleaning of the present invention, which is made into a composition substantially free of an inorganic filler, is used, parts inside an extruder of a shaping machine are not worn away and an

inorganic filler as an impurity does not left inside the apparatus.

Description of Embodiments

[0012] Hereinafter, embodiments of the present invention will be described, but the present invention is not limited to the following embodiments. A resin composition for cleaning of the present invention is a resin composition to be used for cleaning the inside of an extruder or a shaping machine for a resin material, and contains a base material resin and an additive containing at least two selected from the group consisting of a metal soap, a fatty acid amide, and a mineral oil. The base material resin is a thermoplastic resin having a melt flow rate of 1.0 g/10 min or less. Hereinafter, details on the resin composition for cleaning of the present invention will be described.

[0013] (Base Material Resin)

The base material resin is a thermoplastic resin having a melt flow rate of 1.0 g/10 min or less. By using the thermoplastic resin having a melt flow rate of 1.0 g/10 min or less as a base material resin, a certain extent of viscosity is retained even when the base material resin is melted by heating, so that excellent cleaning performance inside an apparatus, such as an extruder or a shaping machine, is exhibited. It is to be noted that the "melt flow rate (MFR)" of a resin in the present specification is a physical property value which is measured in accordance with the test method specified in ISO 1133 (230°C, 21.2 N).

[0014] The melt flow rate of the thermoplastic resin to be used as a base material resin is 1.0 g/10 min or less, preferably 0.6 g/10 min or less, more preferably 0.45 g/10 min or less, and particularly preferably 0.18 g/10 min or less. By using the thermoplastic resin having a melt flow rate of 0.6 g/10 min or less as a base material resin, the cleaning performance can further be enhanced. It is to be noted that the lower limit of the melt flow rate of the thermoplastic resin

is not particularly limited, but substantially, the melt flow rate may be 0.01 g/10 min or more.

[0015] As the thermoplastic resin, a thermoplastic resin which is generally used in various shaping methods, such as an injection shaping method and an extrusion shaping method, can be used. Examples of the thermoplastic resin include a polyethylene-based resin, a polypropylene-based resin, a polystyrene-based resin, an acrylic resin, a polyolefin-based resin, an acrylonitrile-butadiene-styrene copolymer (ABS resin), a polyamide resin, and a polycarbonate resin. These resins can be used singly, or two or more of these resins can be used in combination.

[0016] Examples of the polyethylene-based resin include an ethylene homopolymer, an ethylene-propylene copolymer, and an ethylene-vinyl acetate copolymer. Examples of the polypropylene-based resin include a propylene homopolymer and a propylene-butene copolymer. Examples of the polystyrene-based resin include a styrene homopolymer, an acrylonitrile-styrene copolymer, and a styrene-butadiene copolymer. Examples of the acrylic resin include an acrylic acid ester homopolymer, a methyl methacrylate homopolymer, and an ethylene-ethyl acrylate copolymer. Examples of the polyolefin-based resin include an α -olefin homopolymer and an ethylene- α -olefin copolymer.

[0017] (Additive)

The additive contains at least two selected from the group consisting of a metal soap, a fatty acid amide, and a mineral oil. By blending these additives in the base material resin, a resin composition for cleaning, which has excellent cleaning performance and can easily be replaced with a succeeding material resin, can be made even when the resin composition for cleaning is substantially free of an inorganic filler. Further, since the resin composition for cleaning exhibits sufficient cleaning performance even when an inorganic filler is not contained, the parts inside an apparatus are not worn away, and an inorganic filler is not left inside the apparatus, and

therefore a resin composition for cleaning, which is easy to handle, can be made.

[0018] It is preferable that the additive contain a metal soap and further contain at least any one of a fatty acid amide and a mineral oil because the cleaning performance is further improved, and the replacement with a succeeding material resin is made easier.

[0019][Metal Soap]

The metal soap is usually a metal salt (excluding a sodium salt and a potassium salt) of a long-chain fatty acid. Examples of the metal salt include a metal salt of behenic acid, a metal salt of montanoic acid, a metal salt of lauric acid, a metal salt of stearic acid, and a metal salt of palmitic acid. Examples of the metal that constitutes the metal salt include lithium, magnesium, zinc, aluminum, and calcium. When the inside of an extruder or a shaping machine is cleaned, a resin composition for cleaning is usually heated in a moderate manner into a molten state. Therefore, a metal soap that can melt at a heating temperature (melting temperature) at the time of cleaning is preferably used.

[0020] The content of the metal soap is preferably set to 0.5 to 6.0% by mass, more preferably 1.5 to 5.0% by mass based on the total mass of the resin composition for cleaning. By setting the content of the metal soap within the above-described range, the cleaning performance can further be improved.

[0021][Fatty Acid Amide]

Examples of the fatty acid amide include lauramide, palmitamide, stearamide, hydroxy stearamide, oleamide, erucamide, N-stearyl stearamide, N-stearyl oleamide, N-oleyl stearamide, N-stearyl erucamide, methylol stearamide, methylene bis(stearamide), ethylene bis(capramide), ethylene bis(lauramide), ethylene bis(stearamide), ethylene bis(hydroxy stearamide), ethylene bis(behenamide), hexamethylene bis(stearamide), hexamethylene bis(behenamide), hexamethylene bis(hydroxy stearamide), N,N'-distearyl adipamide, ethylene bis(oleamide), hexamethylene

bis(oleamide), and N,N'-dioleoyl adipamide. These fatty acid amides can be used singly, or two or more of these fatty acid amides can be used in combination.

[0022] As the fatty acid amide, a fatty acid amide that can melt at a heating temperature (melting temperature) at the time of cleaning is preferably used. That is, a fatty acid amide having a higher melting point is preferably used when the heating temperature at the time of cleaning is higher. Specifically, the melting point (mp) of the fatty acid amide is preferably 50 to 250°C, more preferably 100 to 250°C, and particularly preferably 130 to 250°C.

[0023] When the additive contains a fatty acid amide, the content of the fatty acid amide is 1.0% by mass or more, preferably 1.0 to 6.0% by mass, and still more preferably 1.5 to 5.0% by mass based on the total mass of the resin composition for cleaning. In the case where the fatty acid amide is used as the additive, when the content of the fatty acid amide is less than 1.0% by mass, the cleaning performance is insufficient, so that a larger amount of the resin composition needs to be used, and the time required for cleaning cannot be shortened. By setting the content of the fatty acid amide within the above-described range, the cleaning performance is improved, and the replacement with a succeeding material resin is made easy.

[0024] [Mineral Oil]

Any of paraffin-based mineral oils and naphthene-based mineral oils can be used as the mineral oil. Examples of the paraffin-based mineral oils include paraffin wax and liquid paraffin. Among others, a paraffin-based mineral oil is preferably used.

[0025] The content of the mineral oil is preferably set to 1.0 to 6.0% by mass, more preferably 1.5 to 5.0% by mass based on the total mass of the resin composition for cleaning. By setting the content of the mineral oil within the above-described range, the cleaning performance can further be improved.

[0026] (Additional Component)

If necessary, an additional component or additional components other than the above-described components can be contained in the resin composition for cleaning. Examples of the additional component include an antioxidizing agent and an inorganic filler.

[0027] Examples of the antioxidizing agent include a phenol-based antioxidizing agent, a phosphorus-based antioxidizing agent, and a hindered phenol-based antioxidizing agent. Examples of the phenol-based antioxidizing agent include 3,5-di-t-butyl-4-hydroxytoluene. Examples of the phosphorus-based antioxidizing agent include triphenyl phosphite, trilauryl phosphite, tris(nonylphenyl) phosphite, and tris(2,4-di-t-butylphenyl) phosphite. Examples of the hindered phenol-based antioxidizing agent include tetrakis[methylene-3-(3',5'-di-t-butyl-4'-hydroxyphenyl)-propionate]methane.

[0028] The inorganic filler may be contained in a range where the parts inside an apparatus, such as an extruder or a shaping machine, are not worn away, and the inorganic filler is not left as an impurity inside the apparatus. Examples of the inorganic filler include silica, alumina, zeolite, glass fiber, and a natural mineral.

[0029] <Method for Producing Resin Composition for Cleaning>

The resin composition for cleaning of the present invention can be produced by a conventionally known method. For example, the resin composition for cleaning of the present invention can be produced by mixing the previously described base material resin and various additives using a stirring/mixing apparatus. As the stirring/mixing apparatus, an ordinary stirring/mixing apparatus which is used when a resin composition or the like is produced may be used. A resin composition obtained using an extruder may be subjected to melt-kneading at a proper temperature to be extruded and shaped into a pellet shape. As the extruder, a single-screw extruder, a twin-screw extruder, or the like can be used. A pellet-shaped

resin composition for cleaning can be obtained by subjecting a strand extruded from the extruder to cutting underwater or cutting in air, or by other methods.

[0030]<Method for Cleaning Inside of Extruder or Shaping Machine>

By using the resin composition for cleaning of the present invention, the inside of an apparatus, such as an extruder or a shaping machine for a resin material, can be cleaned. To clean the inside of an apparatus, such as an extruder, the resin composition for cleaning may be loaded into the apparatus to operate the apparatus almost in the ordinary manner. It is to be noted that the resin composition for cleaning is usually heated into a molten state at the time of cleaning. The heating temperature is not particularly limited, and may be set in view of the melting points and the like of various components contained in the resin composition for cleaning. After the cleaning is performed with the resin composition for cleaning, the inside of the apparatus is replaced by allowing a succeeding material resin which is a resin for cleaning to flow. The replacement with a succeeding material resin can be carried out under the condition which is similar to the condition for cleaning with the resin composition for cleaning.

Examples

[0031] Hereinafter, the present invention will specifically be described based on Examples, but the present invention is not limited to these Examples. It is to be noted that "part(s)" and "%" in Examples and Comparative Examples are on a mass basis unless otherwise noted.

[0032]<Preparation of Resin Compositions for Cleaning>
(Example 1)

Into a mixer, 93.6 parts of polyethylene (MFR = 0.14 g/10 min), 4.5 parts of zinc stearate (mp = 125°C), 1.5 parts of ethylene bis(capramide) (mp = 161°C), 0.2 parts of a phenol-based antioxidizing agent, and 0.2 parts of a phosphoric acid-based antioxidizing agent were placed and stirred to

obtain a mixture. The obtained mixture was loaded into a twin-screw extruder (screw diameter: 30 mm ϕ), melt-kneaded at 200°C, and extruded to obtain a strand. The obtained strand was cut with a pelletizer to obtain a pale yellowish brown, pellet-shaped resin composition for cleaning.

[0033] (Examples 2 to 10 and Comparative Examples 1 to 3)

Pellet-shaped resin compositions for cleaning were each obtained in the same manner as in Example 1 described previously, except that the respective components were used in such a way as to constitute the composition (unit: part) shown in Table 1. It is to be noted that with respect to Comparative Example 1, a resin composition for cleaning was prepared using the components other than the fatty acid amide (ethylene bis(capramide)), and the fatty acid amide (ethylene bis(capramide)) in the amount shown in Table 1 was added at the time of cleaning.

[0034]

Table 1: Compositions of resin compositions for cleaning

	Example										Comparative Example		
	1	2	3	4	5	6	7	8	9	10	1	2	3
Polyethylene (MFR=0.14g/10min)	93.6	93.6	93.6	89.6	93.6	93.6	93.6				97.6	99.2	93.6
Polyethylene (MFR=0.63g/10min)								93.6					
Polypropylene (MFR=0.50g/10min)									93.6				
ABS (MFR=0.20g/10min)										93.6			
Zinc stearate (mp=125°C)	4.5	3.0	1.5	5.0	3.0	3.0	3.0	3.0	3.0	3.0	1.0		5.6
Ethylene bis (stearamide) (mp=140°C)						3.0							
Ethylene bis (lauramide) (mp=157°C)							3.0						
Ethylene bis (capramide) (mp=161°C)	1.5	3.0	4.5		3.0			3.0	3.0	3.0	1.0*	0.4	0.4
Liquid paraffin				5.0									
Phenol-based antioxidizing agent	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Phosphorus-based antioxidizing agent	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2

*: added at the time of cleaning

[0035]<Cleaning Inside of Apparatus>

(Contamination Step)

A single-screw extruder ($L/D \approx 36$) having a screw diameter of 30 mm ϕ was prepared. Into the prepared single-screw extruder, 80 g of a blue-colored master batch and 1920 g of a resin for dilution (2 kg in total) were loaded and extruded at 210°C to contaminate the inside of the extruder. It is to be noted that as the resin for dilution, the same succeeding material resin as the one described in Table 2 was used. In addition, the blue-colored master batch is obtained by blending about 3.5%

of cyanine blue and about 1.4% of dimethyl quinacridone in the above-described resin for dilution (mixed resin).

[0036] (Cleaning Step)

Each prepared resin composition for cleaning was loaded into the contaminated extruder and extruded under the temperature condition (cleaning temperature (°C)) shown in Table 2 to obtain a strand. Pellets obtained by cutting the obtained strand with a pelletizer were checked visually to measure the time (cleaning time (min)) required until the blue color was not recognized and the use amount (kg) of the resin composition for cleaning. The results are shown in Table 2.

[0037] (Replacement Step with Succeeding Material)

Each type of succeeding material resin shown in Table 2 was loaded into the extruder after the cleaning and extruded under the temperature condition (replacement temperature (°C)) shown in Table 2 to obtain a strand. Pellets obtained by cutting the obtained strand with pelletizer were checked visually to measure the time (replacement time (min)) required until the pale yellowish brown derived from the resin composition for cleaning disappeared and the pellets became colorless and transparent and the use amount (kg) of the succeeding material resin. The results are shown in Table 2.

[0038] <Evaluation of Cleaning Performance>

The cleaning performance of each resin composition for cleaning was evaluated comprehensively according to the evaluation criteria described below. The results are shown in Table 2.

A: the cleaning time is within 6 minutes, and the replacement time is within 2 minutes.

B: the cleaning time exceeds 6 minutes and is within 8 minutes, or the replacement time exceeds 2 minutes and is within 4 minutes.

C: the cleaning time exceeds 8 minutes, and the replacement time exceeds 4 minutes.

[0039]

Table 2: Evaluation results

	Cleaning step			Replacement step with succeeding material				Evaluation of cleaning performance
	Cleaning temperature (°C)	Cleaning time (min)	Use amount (kg)	Succeeding material resin	Replacement temperature (°C)	Replacement time (min)	Use amount (kg)	
Example 1	210	6	0.7	PE	210	2	0.2	A
Example 2	210	6	0.7	PE	210	2	0.2	A
Example 3	210	6	0.7	PE	210	2	0.2	A
Example 4	210	6	0.7	PE	210	2	0.2	A
Example 5	180	6	0.7	PE	210	2	0.2	A
Example 6	210	8	1.0	PE	210	4	0.3	B
Example 7	210	7	0.9	PE	210	3	0.3	B
Example 8	210	9	1.1	PE	210	4	0.3	B
Example 9	220	6	0.7	PP	220	2	0.2	A
Example 10	230	6	0.7	ABS	230	2	0.2	A
Comparative Example 1	210	13	1.6	PE	210	5	0.4	C
Comparative Example 2	210	10	1.2	PE	210	7	0.5	C
Comparative Example 3	210	10	1.2	PE	210	5	0.4	C

Industrial Applicability

[0040] The resin composition for cleaning of the present invention is useful as a resin composition cleaning, to be used for cleaning the inside of an extruder or a shaping machine for a resin material.

CLAIMS

[1] A resin composition for cleaning, to be used for cleaning an inside of an extruder or a shaping machine for a resin material, the resin composition for cleaning, comprising:

a base material resin; and

an additive, wherein

the additive comprises:

a metal soap; and

at least any one of a fatty acid amide and a mineral oil, provided that when the additive comprises the fatty acid amide, the additive has a content of the fatty acid amide of 1.0% by mass or more based on a total mass of the resin composition for cleaning, and

the base material resin is a thermoplastic resin having a melt flow rate of 1.0 g/10 min or less, provided that the thermoplastic resin having a content of an inorganic filler of 3 parts by mass or more based on 100 parts by mass of the thermoplastic resin is excluded.

[2] The resin composition for cleaning according to claim 1, wherein the thermoplastic resin has a melt flow rate of 0.6 g/10 min or less.

[3] The resin composition for cleaning according to claim 1 or 2, wherein the fatty acid amide has a melting point of 50 to 250°C.

[4] The resin composition for cleaning according to any one of claims 1 to 3, having a content of the metal soap of 0.5 to 6.0% by mass based on the total mass of the resin composition for cleaning.

[5] The resin composition for cleaning according to any one of claims 1 to 3, having a content of the metal soap of 1.5 to 5.0% by mass based on the total mass of the resin composition for cleaning.

[6] The resin composition for cleaning according to any one of claims 1 to 5, having a content of at least any one of the fatty acid amide and the mineral oil of 1.0 to 6.0% by mass based

on the total mass of the resin composition for cleaning.

[7] The resin composition for cleaning according to any one of claims 1 to 5, having a content of at least any one of the fatty acid amide and the mineral oil of 1.5 to 5.0% by mass based on the total mass of the resin composition for cleaning.