

Description

The present invention relates to a cleaning process and the corresponding use of a suitable cleaning agent for cleaning poorly accessible machine parts, such as in the transport and/or moulding of materials in the pasty state, in particular in combination with the changeover of the processed material. This principally involves the removal of moulding material residues on changeover to another material. Thus, the invention relates to a simplification of the changeover of the moulding material to be processed in plastic-processing machines, such as, for example, extruders, injection-moulding machines, and blow-moulding equipment by accelerating the removal of the previous substance from the plasticizer unit and the nozzle region; an analogous field of use is, for example, in the operation of kneaders.

Since long, a wide variety of different cleaning agents is used in technical and household applications. E.g., FR-A-2 593 187 relates to a degreasing agent for metal and plastics parts, the degreasing agent containing, apart from water and sodium metasilicate, glycol ethers and alkylbenzene sulfonates as active ingredients.

In US-A-3 367 878 a cleaning agent for removing asphalt, sodium and/or metallic soap greases, road dirt, forming and cutting oils, and aviation dirt from ferrous and non-ferrous metal surfaces is claimed, the cleaning agent containing specific glycols (hexylene glycol, propylene glycol) as active ingredients together with a specific organic chelating ingredient, namely the tetrasodium salt of ethylene diamine tetraacetic acid in combination with water and sodium salts.

A cleanser for removing lard and other grease at temperatures of about 65,6 °C from ovens, cookers, pots and tiles is described in DE-A-2 300 744. This cleanser is a water-comprising composition with ammonia, or an organic amine together with organic cleaning compounds, and specific organic amides. The inorganic material which is also present in the cleanser of DE-A-2 300 744 is, at least partly, an abrading agent.

In the production of defined mouldings from pasty materials, such as, for example, thermoplastics or dwo-plastics, and also in the processing of other substances in the softened state, as the melt or paste, the following has been experienced: in machine parts which come into contact with the viscous moulding material, for example the plasticizer and the nozzle in injection moulding, moulding material is retained. These residues are gradually discharged on changeover and contaminate the subsequent mouldings and result in mouldings which are unusable for aesthetic or physical reasons.

This problem occurs, for example, in the plastics-processing industry when the colour is changed within a series. The losses in time, energy and raw materials until products of perfect colour are achieved are considerable.

Thus, it can be expected that a throughput of 650 kg of ABS (acrylonitrile-butadiene-styrene) material will be needed until pure white mouldings are produced in the customary injection-moulding manufacture of parts weighing 350 g on changing the colour from a beige ABS material to a similar white material.

The cleaning process outlined above, i.e. working with a new material until perfect mouldings are achieved, and discarding the unusable mouldings made of a mixed material, cannot be justified from economic (material and energy costs for unusable products) and disposal points of view (burden on dumps caused by unusable and substantially undecomposable mouldings, environmental pollution on incineration, poor opportunity for recycling due to the material mixture).

Disassembly and manual cleaning is likewise an expensive method. In order to circumvent this problem, a further method is known from the prior art.

This involves the introduction of abrasion particles, for example Al_2O_3 , in suspension with organic solvents. The abrasion particles are added to the feed hopper of the plasticator together with the solvent, usually an aromatic, and the starting material in granule, chip or other form. Due to the combined action of the organic solvent, which at least causes the material residues in the screw channel and in the nozzles to swell, thus simplifying removal, and the abrasive action of the abrasion particles, the amount of unusable mouldings made from a mixed material is significantly reduced due to the more rapid removal of residual substances.

However, cleaning agents of this type are not without problems from industrial safety and environmental points of view.

The transport, storage and handling of cleaning agents of this type are associated with risks due to the necessary presence of organic solvents, whose flammability and/or toxicity makes them potential hazards.

For reasons of labour and property protection, their handling is subject to official regulations (for example West German Flammable Liquids Regulations; Transport of Hazardous Materials Regulations; Chemicals Act; Hazardous Industrial Materials Regulations). Since it is necessary for vapours to escape when these substances are warmed in the machine, the guide concentrations (MAC values) can easily be exceeded locally.

In addition, the amounts used are not inconsiderable. Depending on the dimensions of the machine to be cleaned, 0.2 l to 1.5 l of suspension are employed per changeover. The stocks in the plant must be arranged appropriately, which means that there is a not inconsiderable long-term risk.

In addition, the low stability of the suspensions results in careful mixing being necessary before use if the desired degree of distribution in the starting material, and thus the desired action, are to be achieved.

The object of the present invention is therefore to provide cleaning process which reliably and quickly helps to remove residues of the previously processed molten material using only a small amount of the subsequent material, it being possible to formulate a cleaning agent for use according to the present invention so that it is easy to handle and produces no problems with respect to the danger of fire and toxicity.

This object was surprisingly achieved by the cleaning process according to Claims 1 and the use of a cleaning agent according to Claim 6. The relevant Sub-Claims 2 to 5 and 7 to 9 represent expedient embodiments of the invention.

As shown in the working example, the cleaning process according to the invention is highly efficient. Material changeovers which otherwise require several hours and produce a large amount of rejects can be carried out within a few minutes. It must also be realised that H₂O can be used as a solvent which presents absolutely no toxicological problems in humans or the environment. As far as salts which are suitable with respect to the melting points are concerned, there is a sufficiently large choice of substances, known to any chemist, which are not hazardous materials. Most of the plastics-processing processes which are important here operate at temperatures between 100 and 200°C. It arises from the objective that the salts, solvents and all the additives must be colourless and inert at the processing temperature of subsequent material.

Since the active substance and the organic and/or inorganic salt are, in accordance with the invention, in the form of a solution, homogeneity is ensured. Separation, with subsequent distribution problems in the granules, i.e. a poor cleaning action, cannot occur.

With respect to homogenous dispersion in the material for plastification, however, addition of surfactants so that the surface tension between the particular plastic and the cleaning solution is reduced proves expedient in the process and agent according to the invention.

The cleaning process and the use of a suitable cleaning agent according to the invention are not limited to certain types of material or certain combinations of successive substances. Examples which may be mentioned are: ABS, AMMA, CA, DPA, EP, EVA, EVAL, HDPE, LDPE, MBS, PA, PC, PMMA, PS, PVC, POM, PPR, PBT, SAN, and UF. The moulding materials may be filled or unfilled.

With regard to the reduction of the danger of corrosion of metallic machine parts, it proves expedient to employ a cleaning solution having a pH of from 7 to 14. The use of a basic salt, such as, for example, Na₂CO₃, or alternatively sodium metasilicate is appropriate due to the acid-neutralizing action, in particular when PVC or other acid-eliminating materials are used.

Although it is generally not necessary to use organic polar or non-polar solvents in the present invention, it may be expedient, in the case of residues which are particularly difficult to remove, to add organic solvents, if appropriate together with an emulsifier, to the cleaning solution. In these cases too, the amount of solvent employed is many times smaller than in the case of customary cleaning suspensions, with the same cleaning action.

The concentration of the salt in the cleaning agent for use according to the invention can vary within broad limits. An activity lower limit for the concentration is at about 0.5% by weight. For reasons of easier handling during transport and storage and in order to limit the volume of liquid to be evaporated, higher concentrations are advisable as long as the viscosity does not make discharge and distribution more difficult. However, it is of course possible to appropriately dilute a solution concentrated in this way "on site". In addition, salts and solvents can be kept separate before use. The actual cleaning solution is then prepared immediately before use by dissolving the solid salts. It is likewise possible to keep additives, for example alkalizing agents such as NaOH, separate for storage and transport in the form of a "kit of parts" and only to add them when the solution is used.

The working example below illustrates the effectiveness of the procedure according to the invention:

Example

The following materials were processed under laboratory and production conditions, coloured pigments being used in batch, powder and liquid state: ABS, CA, HPDE, LPDE, PA, PA 6, PA 6.6, PA 11, PA 12, PC, PE, PMMA, PPO, PPS, PS, soft PVC, SAN, PBT and PPR.

Most of the PA groups have been modified with short and long glass fibres and with glass beads up to 35%, and also with MoS (2 to 2.5%).

Experiments were carried out in the following injection-moulding machines:

Arburg 221 - 75 - 350

Screws: 0 20

0 25

0 30

Arburg 305 - 210 - 700

0 30

0 40

0 45

Arburg Eco 305 - 700 - 230

0 35

0 40

Rico 110

0 60

0 65

I. Production of casings for automatic coffeemakers:

Machine: 200 t

Screw: 65 0

Mould: hot channel 1-fold

Material: ABS - colours

Changeover from dark brown to beige:

a) conventionally by introducing the subsequent material;

It was necessary to twice disassemble the mould and carry out mechanical cleaning before the beige colour shade was satisfactory

Material consumption: about 600 g of ABS

Time consumption: about 10 hours

b) using the cleaning agent according to the invention (Na_2CO_3 , 10% strength by weight, in distilled H_2O ; 0.03 kg)

Material consumption: about 6 kg of ABS

Time consumption: about 15 minutes

The changeover was likewise completed in about 15 minutes using sodium metasilicate (10% strength by weight in distilled H_2O ; 0.03 kg).

II. Production of disposable razors:

Machine: 250 t

Screw: 80 0

Mould: hot channel, 12-fold

Material: high-impact PS colours on colour changeover

a) conventionally without cleaning agent with multiple disassembly of the mould and mechanical cleaning in each case before the changeover was complete

Material consumption: about 350 kg of PS

Time consumption: about 24 hours

Simple cleaning (only the plasticizing unit) took about 10 minutes.

Vented screws were an exception. They could not be cleaned according to the invention in the pressure-free

end region, but instead had to be subjected to manual cleaning.

Claims

1. Process for cleaning poorly accessible machine parts in the transport and/or moulding of materials in the pasty state, in particular for removal of moulding material residues on changeover of the material, characterized in that at least one organic and/or inorganic salt in solution with one or more polar inorganic and/or organic solvent(s) which dissolve the salt or these salts, is introduced into the operating machine together with the first batch of the subsequent material, preferably as a solution, if appropriate with addition of further substances, such as surfactants, organic solvents, alkalizing agents, emulsifiers, abrasion particles and the like, the melting point of the organic or inorganic salt(s) being above the processing temperature of the subsequent material, and the boiling point of the solvent(s) being below the processing temperature of the subsequent material.

2. Process according to claim 1, characterized in that the solvent is water.

3. Process according to claims 1 or 2, characterized in that the salt component of the solution comprises alkali metal carbonate(s), alkali metal metasilicate(s), alkali metal tartrate(s), alkali metal acetate(s) or mixtures thereof.

4. Process according to claims 1 to 3, characterized in that the boiling point of the solvent(s) is at least 30°C below the processing temperature of the subsequent material.

5. Process according to claims 1 to 4, characterized in that the melting point of the anhydrous salt or salts is at least 50°C above the processing temperature of the subsequent material.

6. Use of liquid readymade cleaning agents for carrying out the process according to claims 1 to 5, characterized in that the cleaning agent comprises at least one inorganic and/or organic salt in solution with one or more inorganic and/or polar organic solvent(s), wherein the melting point of the salt or these salts is above the processing temperature of the subsequent material and the boiling point of the solvent(s) is below the processing temperature of the subsequent material.

7. Use according to claim 6, characterized in that the concentration of the salt(s) is at least 0.5% by weight, based on the total weight of the solution, preferably 5% by weight to 20% by weight, and the salt concentration can be up to the saturation limit at room temperature.

8. Use according to claims 6 and 7, characterized in that the pH-Wert of the cleaning agent is in the range of 4 to 14, preferably in the range of 8 to 11.

9. Use according to claims 6 to 8, characterized in that salt(s) and solvent(s) comprised in the cleaning agent correspond to claim 2 to 5.

Patentansprüche

1. Verfahren zur Reinigung schwer zugänglicher Maschinenteile bei der Förderung und/oder Formung von Werkstoffen im pastösen Zustand, insbesondere für die Entfernung von Formmassenrückständen bei der Umstellung des Werkstoffs, dadurch gekennzeichnet, daß wenigstens ein organisches und/oder anorganisches Salz in Lösung mit einem oder mehreren polaren anorganischen und/oder organischen Lösemittel(n), die das Salz oder diese Salze lösen, gemeinsam mit der ersten Partie des Folgewerkstoffs in die im Betrieb befindliche Maschine eingebracht werden, vorzugsweise als Lösung, gegebenenfalls unter Zusatz weiterer Substanzen, wie Tensiden, organischem Lösemittel, Alkalisierungsmitteln, Emulgatoren, Abrasionspartikeln und dergleichen, wobei der Schmelzpunkt der oder des organischen oder anorganischen Salz(es) über der Verarbeitungstemperatur des Folgewerkstoffs liegt und der Siedepunkt des oder der Lösemittel(s) unter der Verarbeitungstemperatur des Folgewerkstoffs liegt.

2. Verfahren nach Anspruch 1, dadurch gekennzeichnet, daß das Lösemittel Wasser ist.

3. Verfahren nach Ansprüchen 1 oder 2, dadurch gekennzeichnet, daß der Salzbestandteil der Lösung Alkalicarbonat(e), Alkalimetasilicat(e), Alkalitartrat(e), Alkaliacetat(e) oder Gemische daraus umfaßt.

4. Verfahren nach Ansprüchen 1 bis 3, dadurch gekennzeichnet, daß der Siedepunkt des oder der Lösemittel(s) wenigstens um 30°C unter der Verarbeitungstemperatur des Folgematerials liegt.

5. Verfahren nach Ansprüchen 1 bis 4, dadurch gekennzeichnet, daß der Schmelzpunkt des oder der Salze, wenn sie in wasserfreier Form vorliegen, wenigstens um 50°C über der Verarbeitungstemperatur des Folgematerials liegt.

6. Verwendung von flüssigen Fertigreinigungsmitteln zur Durchführung des Verfahrens nach Ansprüchen 1 bis 5, dadurch gekennzeichnet, daß das Reinigungsmittel mindestens ein anorganisches und/oder organi-



end region, but instead had to be subjected to manual cleaning.

Claims

1. Process for cleaning poorly accessible machine parts in the transport and/or moulding of materials in the pasty state, in particular for removal of moulding material residues on changeover of the material, characterized in that at least one organic and/or inorganic salt in solution with one or more polar inorganic and/or organic solvent(s) which dissolve the salt or these salts, is introduced into the operating machine together with the first batch of the subsequent material, preferably as a solution, if appropriate with addition of further substances, such as surfactions, organic solvents, alkalinizing agents, emulsifiers, abrasion particles and the like, the melting point of the organic or inorganic salt(s) being above the processing temperature of the subsequent material, and the boiling point of the solvent(s) being below the processing temperature of the subsequent material.

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4. Process according to claims 1 to 3, characterized in that the boiling point of the solvent(s) is at least 30°C below the processing temperature of the subsequent material.

5. Process according to claims 1 to 4, characterized in that the melting point of the anhydrous salt or salts is at least 50°C above the processing temperature of the subsequent material.

6. Use of liquid readymade cleaning agents for carrying out the process according to claims 1 to 5, characterized in that the cleaning agent comprises at least one inorganic and/or organic salt in solution with one or more inorganic and/or polar organic solvent(s), wherein the melting point of the salt or these salts is above the processing temperature of the subsequent material and the boiling point of the solvent(s) is below the processing temperature of the subsequent material.

7. Use according to claim 6, characterized in that the concentration of the salt(s) is at least 0,5% by weight, based on the total weight of the solution, preferably 5% by weight to 20% by weight, and the salt concentration can be up to the saturation limit at room temperature.

8. Use according to claims 6 and 7, characterized in that the pH-Wert of the cleaning agent is in the range of 4 to 14, preferably in the range of 8 to 11.

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1. Verfahren zur Reinigung schwer zugänglicher Maschinenteile bei der Förderung und/oder Formung von Werkstoffen im pastösen Zustand, insbesondere für die Entfernung von Formmassenrückständen bei der Umstellung des Werkstoffs, dadurch gekennzeichnet, daß wenigstens ein organisches und/oder anorganisches Salz in Lösung mit einem oder mehreren polaren anorganischen und/oder organischen Lösemittel(n), die das Salz oder diese Salze lösen, gemeinsam mit der ersten Partie des Folgewerkstoffs in die im Betrieb befindliche Maschine eingebracht werden, vorzugsweise als Lösung, gegebenenfalls unter Zusatz weiterer Substanzen, wie Tensiden, organischem Lösemittel, Alkalisierungsmitteln, Emulgatoren, Abrasionspartikeln und dergleichen, wobei der Schmelzpunkt der oder des organischen oder anorganischen Salz(es) über der Verarbeitungstemperatur des Folgewerkstoffs liegt und der Siedepunkt des oder der Lösemittel(s) unter der Verarbeitungstemperatur des Folgewerkstoffs liegt.

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5. Verfahren nach Ansprüchen 1 bis 4, dadurch gekennzeichnet, daß der Schmelzpunkt des oder der Salze, wenn sie in wasserfreier Form vorliegen, wenigstens um 50°C über der Verarbeitungstemperatur des Folgematerials liegt.

6. Verwendung von flüssigen Fertigreinigungsmitteln zur Durchführung des Verfahrens nach Ansprüchen 1 bis 5, dadurch gekennzeichnet, daß das Reinigungsmittel mindestens ein anorganisches und/oder organi-



sches Satz in Lösung mit einem oder mehreren anorganischen und/oder potaren organischen Lösemittel(n) enthält, wobei der Schmelzpunkt der oder des Salze(s) über der Verarbeitungstemperatur des Folgewerkstotts liegt und der Siedepunkt der oder des Lösemittel(s) unter der Verarbeitungstemperatur des Folgewerkstotts liegt.

5 7. Verwendung nach Anspruch 6, dadurch gekennzeichnet, daß die Konzentration der oder des Salz(es) mindestens 0,5 Gew.% bezogen auf die Gesamtmasse der Lösung, bevorzugt 5 Gew.% bis 20 Gew.% beträgt und die Salzkonzentration bis zur Sättigungsgrenze bei Raumtemperatur betragen kann.

8. Verwendung nach Ansprüchen 6 und 7, dadurch gekennzeichnet, daß der pH-Wert des Reinigungsmittels im Bereich 4 bis 14, vorzugsweise im Bereich von 8 bis 11 liegt.

10 9. Verwendung nach Ansprüchen 6 bis 8, dadurch gekennzeichnet, daß das oder die Salz(e) und Lösemittel, die in dem Reinigungsmittel enthalten sind, den Ansprüchen 2 bis 5 entsprechen.

Revendications

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1. Procédé de nettoyage de pièces de machine difficilement accessibles dans le transport et/ou le moulage de matières à l'état pâteux, en particulier pour l'élimination de résidus de matière de moulage lors du changement de matière, caractérisé en ce qu'on introduit dans la machine en fonctionnement au moins un sel organique et/ou minéral en solution dans un ou plusieurs solvants inorganiques et/ou organiques polaires qui dissolvent le ou les sels, en même temps que le premier lot de la matière ultérieure, de préférence sous forme de solution, si nécessaire avec addition d'autres substances telles que des agents tensio-actifs, des solvants organiques, des agents alcalinisants, des émulsionnants, des particules abrasives etc., le point de fusion du ou des sels organiques ou minéraux étant au-dessus de la température de traitement de la matière ultérieure, et le point d'ébullition du ou des solvants étant inférieur à la température de traitement de la matière ultérieure.

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2. Procédé selon la revendication 1, caractérisé en ce que le solvant est l'eau.

3. Procédé selon les revendications 1 ou 2, caractérisé en ce que le constituant sel de la solution comprend un ou plusieurs carbonates de métaux alcalins, un ou plusieurs métasilicates de métaux alcalins, un ou plusieurs tartrates de métaux alcalins, un ou plusieurs acétates de métaux alcalins, ou des mélanges de ceux-ci.

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4. Procédé selon les revendications 1 à 3, caractérisé en ce que le point d'ébullition du ou des solvants est inférieur d'au moins 30°C à la température de transformation de la matière ultérieure.

5. Procédé selon les revendications 1 à 4, caractérisé en ce que le point de fusion du ou des sels anhydres est supérieur d'au moins 50°C à la température de transformation de la matière ultérieure.

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6. Utilisation d'agents de nettoyage liquides prêts à l'emploi pour effectuer le procédé conforme aux revendications 1 à 5, caractérisé en ce que l'agent de nettoyage comprend au moins un sel minéral et/ou organique en solution avec un ou plusieurs solvants inorganiques et/ou organiques polaires, dans laquelle le point de fusion du ou des sels est supérieur à la température de transformation de la matière ultérieure et le point d'ébullition du ou des solvants est inférieur à la température de transformation de la matière ultérieure.

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7. Utilisation selon la revendication 6, caractérisée en ce que la concentration du ou des sels est d'au moins 0,5% en poids, par rapport au poids total de la solution, de préférence de 5% en poids à 20% en poids, et la concentration en sel peut aller jusqu'à la limite de saturation à la température ambiante.

8. Utilisation selon les revendications 6 et 7, caractérisée en ce que le pH de l'agent de nettoyage est dans l'intervalle de 4 à 14, de préférence dans l'intervalle de 8 à 11.

9. Utilisation selon les revendications 6 à 8, caractérisée en ce que le ou les sels et le ou les solvants contenus dans l'agent de nettoyage correspondent aux revendications 2 à 5.

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