Title: COMPOSITION FOR MOLDING ARTICLES AND METHOD FOR PREPARING MOLDED ARTICLES THEREFROM

Abstract: The present invention relates to a composition for molding articles and method for preparing molded articles therefrom. The composition according to the present invention comprising: 90 parts by weight or less of grain powder as a base material and 20 parts by weight or less of compounds containing at least one component selected from the group consisting of hydroxyl (R-OH), ester (R-CO2R'), carboxylic acid (R-CO2H), amide (R-CO-NH-R'), imides (R-CO-NH=CO-R'), amine (R-NH2), anhydride (R-CO2CO-R'), phosphoric acid (R-PO3H2), sulfonic acid (R-SO3H), and melamine (wherein, R and R' are independently H, aliphatic or aromatic organic compounds, or organic compounds containing the above-mentioned components) as a molding assistant. The composition may further comprise at least one additive selected from the group consisting of molding texture binders and functional improvers for molded articles. The additive is used at an amount of 90 parts by weight or less based on the weight of the composition. Therefore, the composition in accordance with the present invention is environmentally friendly because its materials are natural products and economically favorable because its materials can be obtained with ease and are low-priced.
COMPOSITION FOR MOLDING ARTICLES AND METHOD FOR PREPARING
MOLDED ARTICLES THEREFROM

TECHNICAL FIELD

The present invention relates, in general, to a composition for molding articles and, more particularly, to a composition based on an environmentally friendly material, which can be molded into articles which are harmless to the body and the environment and biodegradable or biodisintegrative. Also, the present invention is concerned with a method for preparing such an article from the composition.

BACKGROUND ART

In prevailing plastic articles are usually contained environmental hormones which are harmful to the body. Environmental hormones, scientifically called endocrine disrupters, are generic materials that interrupt or disrupt the action of hormones in human or animal bodies. The name “environmental hormones” was given to them because they act just like natural hormones in vivo, owing to their chemical structures which are similar to natural hormones’. Once introduced into the body, environmental hormones may bring about serious health problems in humans, including reproductive function abnormalities, breakdown of sex ratio balance,
unbalanced hormone secretion, immune function suppression, and increased rate of breast and prostatic cancers.

For these reasons, policies have been directed to the regulation of the use of environmental hormone-causing materials or articles in many countries. For example, recent legislation, in response to environmental concerns stemming from environmental hormones and pollution, has been enacted to prohibit the use of environmental hormone-causing materials or articles in children’s and dietary products.

Various plastic material-based articles, such as household goods, domestic articles, daily necessities, construction materials, packing materials, and the like, are greatly troublesome to dispose of after their effective life spans. If the waste articles are left in nature as they are, they will not be putrefied, but will remain intact for tens to hundreds of years. When the waste articles are incinerated, not only particulate air pollutants, but also carcinogens such as dioxin are produced, seriously threatening the health of humans.

Therefore, there remains a particular need to develop novel materials, which do not contain or release environmental hormones nor create the problems generated upon the disposal of conventional plastic-based articles. In fact, extensive research and investments is being directed toward the development of such substitutes for conventional plastics in many countries.
DISCLOSURE OF THE INVENTION

It is an object of the present invention to provide a composition suitable for use in molding articles, which can substitute for plastic materials without releasing environmental hormones nor produce pollutants of the environment and present disposal problems.

It is another object of the present invention to provide a method for preparing articles from such a composition.

In accordance with an embodiment of the present invention, there is provided a composition for molding articles, comprising: 90 parts by weight or less of grain powder as a base material and 20 parts by weight or less of compounds containing at least one component selected from the group consisting of hydroxyl(R-OH), ester(R-CO₂R'), carboxylic acid(R-CO₂H), amide(R-CO₂R'), imides(R-CO₂R'), amine(R-NH₂), anhydride(R-CO₂CO-R'), phosphonic acid(R-P(OH)₂), sulfonic acid(R-SO₄H) and melamine(wherein, R and R' are independently H, aliphatic or aromatic organic compounds, or organic compounds containing the above-mentioned components) as a molding assistant.

In one version of this embodiment, the composition may further comprise at least one additive selected from the group consisting of molding texture binders and functional improvers for molded articles.

In another version of this embodiment, the additive
is used at an amount of 90 parts by weight or less based on the weight of the composition, and the molding texture binder is a fibrous material.

In accordance with another embodiment of the present invention, there is provided a method for preparing a molded article, comprising the steps of: homogeneously mixing a composition comprising 90 parts by weight or less of grain powder as a base material and 20 parts by weight or less of a molding assistant; loading the composition on a molding machine; and molding the composition into an article for a predetermined period of time at a predetermined atmosphere.

BRIEF DESCRIPTION OF THE INVENTION

Fig. 1 is a partially broken perspective view showing a molded article in accordance with an embodiment of the present invention.

Fig. 2 is a process flow chart illustrating a method for preparing molded articles from a composition in accordance with another embodiment of the present invention.

BEST MODES FOR CARRYING OUT THE INVENTION

The application of the preferred embodiments of the present invention is best understood with reference to
the accompanying drawings.

Fig. 1 shows a molded article prepared from a composition of the present invention in a partially broken perspective view.

According to molding techniques, the composition may be molded into various forms. In Fig. 1, there is an article 10 which has an ordinary bowl form. A body 15 of the article 10 is prepared from a composition comprising wheat flour and a molding assistant powder, the article 10 has two coating layers 20 and 25 which are for its exterior and interior, respectively. The article 10 may alternatively be coated only on its one side or prepared with no coating. Since a powder phase of the composition can be pressurized without being modified additionally in a molding machine, the present invention is advantageous in that the molding process is simplified.

As the base material of the composition for molding articles, wheat flour is the most preferable, but the present invention is not limited to this. For example, an ordinary carbohydrate-based grain powder such as rice, starch, barley, or corn powder may be used as a base material for the molding composition. In order to mold articles, grain powders may be used as they are or in a viscous form, for example, dough mixed with a small quantity of water. Thus, the base material of the present invention may be in the form of powder, dough, and liquid. In addition, suitable for use as a base material for the composition of the present invention is
a natural product or by-product such as chaff, sawdust, starch, glue, fish glue, or rice. In place of wheat flour, finely ground powders of these materials may be applied for the present invention. In addition to being light, the molded articles prepared from grain powders in accordance with the present invention, as mentioned previously, are environmentally friendly because they release no toxic materials to the environment upon biodegradation.

As for the molding assistant, it is most preferably the said materials, but is not limited thereto. For example, a pine resin is effectively used as a molding assistant by taking advantage of its molding-beneficial properties, such as foaming properties. However, the molding assistant materials must be selected discreetly in order to meet the environmentally friendly requirements of the final molding products. In particular, the contents of components contained in the molding assistant must be selected in consideration of their influence on the body and the environment.

The molding assistant may be a variety of resins obtained from nature sources, for example, pine resin and natural rubbers. Usually, they are used as foaming or coating materials. In the present invention, the resins serve to maintain the final products in molded forms and to represent glosses on the surface of the final products. Representative of the said resins is a pine resin. For use, the pine resin is deprived of oil and moisture and
the residues are dried and powdered.

In addition, suitable for use as molding assistants for the composition of the present invention are compounds containing at least one component selected from the group consisting of hydroxyl (R-OH), ester (R-CO₂R'), carboxylic acid (R-CO₂H), amide (R-CO-NH-R'), imides (R-CO-NHCO-R'), amine (R-NH₂), anhydride (R-CO₂CO-R'), phosphoric acid (R-PO₃H₂), sulfonic acid (R-SO₄H₂) and melamine (wherein, R and R' are independently H, aliphatic or aromatic organic compounds, or organic compounds containing the above-mentioned components), but is not limited thereto. Any materials may be used if they can improve molding ability. In addition, the compounds may have various molecular weight and structure according to the components therein.

Suitable for use as molding texture binders are powdered fibrous materials such as stems and leaves of various herbs and trees. By way of example, but not limitation, the fibrous materials include wormwood, reed, wheat straw, barley straw, rice straw, cotton and their debris. Any materials may be used if they provide vegetable fibrous components. The molding texture binder serves to fortify the bonding strength between neighboring molding textures as well as contributing greatly to the physical properties of the final products, especially the strength of the molded products. Comparing molded products prepared from the base material and the molding assistant; and from the base material,
the molding assistant and the molding texture binder clearly demonstrates the great contribution of the molding texture binder to the strength of the products.

Preferred, non-limitative examples of functional improvers for molded articles include stone powder, soil powder, fine sand powder, and fine yellow earth powder. In addition to bringing about an improvement in the strength of the final product, the functional improver allows the final product to have the appearance and functions of potteries. When employing such a functional improver, the molded articles are suitable for use in household wares and various construction materials such as pavement blocks. However, their functions cannot be sufficiently expressed without completely waterproofing the molded articles. When waterproofed, therefore, application of an appropriate amount of at least one functional improver selected from soil powder, fine sand powder and fine yellow earth powder allows the final products to be freely expressed in strength, color, weight, and thickness. In other words, the final products can be prepared with suitable properties depending on their intended final uses.

Since they are obtained from natural sources, the grain powders and the above-mentioned resins contained in the molded articles according to the present invention are harmless to the body and friendly to the environment. The molding assistants play a role in determining the transparency of the molded articles. The more the
molding assistant, the clearer the final product. Thus, the transparency of the final molded article can be controlled with the content of the molding assistant. The molded articles of the present invention cannot be made completely transparent like glass articles, but shows high transparency by controlling the content of the molding assistant.

The composition for molding articles in accordance with the present invention may be in the form of a powder, dough, or a liquid. When articles are produced by molding, they are usually used in liquid forms. However, the present invention is advantageous in that the compositions can be employed irrespective of whether they are in a liquid phase or a powder phase. In particular, in the case that a powder phase of the composition is used for the molding, the powder phase can be fed, as it is, into a molding machine and pressurized. Thus, the present invention enjoys the advantage of simplifying the molding process. As a result, a powder phase of the composition for molding articles in accordance with the present invention allows the molding process to be simply organized and thus, can reduce the production cost.

Now, a description will be given of the process for molding an article from the composition, in conjunction with Fig. 2.

Fig. 2 is a process flow of producing a molded article from the composition of the present invention.

As shown in Fig. 2, appropriate amounts of
composition constituents are prepared and homogeneously mixed (S1). For the mixing, a separate stirrer may be used. When the composition is prepared in a powder phase, it may undergo a separate drying process to control its moisture content or it may be hydrated to retain an appropriate moisture content. On the whole, a powder is virtually impossible to store in a completely dried state if exposed to the air, and exhibits an unavoidable moisture content. During storage and processing, the powder composition may be changed in its moisture content depending on ambient temperature and humidity. Since the moisture content of the composition may have a direct influence on the storage of the raw materials and/or the maintenance of molded shapes of final products, the moisture content needs to be controlled diversely and accurately in accordance with the intended uses of the final products.

When the composition is prepared in a liquid phase, a drying process is separately demanded for molded articles. Unless the moisture content of the final product is accurately controlled, it may slowly disintegrate because of the moisture content.

A greater content of the molding assistant, in the composition of the present invention, as mentioned previously, leads to higher transparency of the final product. When the base material is used at an amount of 90 parts by weight, greater than 20 parts by weight of the molding assistant is not favorable in consideration
of production costs. However, it should be understood that a greater amount of the molding assistant than the amount limit is not unable to achieve the object of the present invention, but is merely unfavorable in an economic aspects, and is within the scope of the invention.

Returning now to Fig. 2, the prepared composition is colorized (S2). For this, an edible dye with a desired color is added in an appropriate amount to the homogeneously mixed composition. Done to express a color on the final product, this colorizing step is, however, optional. Various colors can be expressed on the molded articles by applying various edible dyes.

Next, a powder phase or a liquid phase of the prepared composition is molded into a desired shape in a molding machine under appropriate conditions (S3). In regard to the molding conditions, important parameters include temperature, pressure and time. In accordance with the present invention, the molding temperature is preferably controlled within the range of 100-200 °C, the molding pressure within the range of 200-400 kg/cm², and the molding time within the range of several seconds to tens of seconds. In fact, control of the molding conditions is the most important factor in successfully conducting the molding process. Excessive temperature, pressure or time may cause the molded article to be burned or discolored. In one embodiment of the present invention, the composition is molded at 150 °C for about
20 sec under a pressure of 300 kg/cm². However, the molding condition parameters of pressure, temperature and time may be diversely controlled depending on the intended uses of the final products.

Finally, a molded article is coated on one or both sides (S4). The molded articles prepared from the composition of the present invention are biodegradable or biodisintegrative and addition of a small amount of water suffices for the disposal of the articles. However, when in use, contact with water must be avoided. For this reason, a waterproofing treatment may be conducted on the surfaces of the molded articles. Further, functional surface layers may be provided to bring about an improvement in appearance, strength, flame resistance, wear resistance, and etc.

To form such a functional surface layer, the above-mentioned resin, serving as a molding assistant, may be used. Formation of such a functional surface layer may be achieved by adding a surface-improving material during the molding or by coating the surfaces of molded articles after the molding. However, particular care must be taken of materials and their amounts used for the functional surface formation lest they run counter to the object of the present invention to produce biodegradable articles.

The molded articles prepared according to the present invention can find numerous applications in many fields. For instance, the molded articles may be used as
general household wares or daily necessities or applied to construction materials or packing materials. In addition, the molded products with fortified functions can be applied where conventional wood, plastics, iron or ceramic materials are used. Moreover, in addition to being harmless to the body and producing no pollutants of the environment, the molded articles of the present invention can be used as feedstuff or fertilizers after their life spans.

Additionally, the composition for molding articles in accordance with the present invention is environmentally friendly because its materials are natural products. Another advantage of the present invention is that the composition of the present invention is economically favorable because its materials can be obtained with ease and are low-priced. If the molded articles cannot be used in their intended fashion because of damage or expired life span, they can be utilized as molding materials for new articles.

Also, the method for molding articles in accordance with the present invention is very advantageous in the following aspects: First, the composition useful in the method is easily prepared. Additionally, the method is so simple as to reduce the production cost of the final products. Thus, the final products are price-competent.

The molded articles prepared according to the present invention, if care is taken not to stain them, can be used repeatedly. Even when they are stained, the
molded articles according to the present invention can be used many times if the stains are properly taken out.

Although the preferred embodiments of the present invention have been disclosed for illustrative purposes, those skilled in the art will appreciate that various modifications, additions and substitutions are possible, without departing from the scope and spirit of the invention as disclosed in the accompanying claims.

Therefore, the present invention, which is directed to a composition and a molding method using the same, produces environmentally friendly articles which can at least partially solve the problems of environmental hormones and pollutants. In addition, low-priced materials for the compositions of the present invention, such as wheat flour, make the final products price-competent. Furthermore, even after their endurance terms or life spans, the molded articles of the present invention can be utilized as materials for other articles. In addition, when they are disposed of as they are, the molded articles of the present invention are easily degraded by microorganisms without producing any harmful materials to the body and the environment.

Numerous applications of the molded articles prepared from the molding composition by the method according to the present invention exist in housewares, supplies, construction and other industries. By way of examples, but not limitation, the molded articles according to the present invention can be applied to
disposable supplies such as ramen containers, trays, dishes, chopsticks, toothbrushes, razor handles, knives, spoons, hamburger containers, ice cream containers, ice cream sticks, ice cream spoons, stirring sticks for coffee, toothpicks, forks, straws, golf tees, and food vessels; reusable supplies such as meal trays, salvers, vessels, cups, gourds, restaurant vessels, dishes, and packing materials; daily necessities such as coat hangers, dustbins, picture frames, toys, vases, pencil cases, cases for spoons and chopsticks, ash trays, wall/table clock cases, disc boxes, knitting needles, and spectacles frames; office supplies such as ball pen cases, pencil cases, scotch tape frames, furniture subsidiaries, office desks, clothes chests, and bookshelves; materials for interior and exterior decoration such as floors, ceiling materials, boards, window frames, fasteners, doors, kitchen furniture, molding materials for interior decoration, substitutes for MDF, and panels; plastic substitutes such as housing for TV sets, computers, various electronic appliances, phones and cellular phones, toys, living necessaries, FRP substitutes, and various food containers; various shock absorbers such as egg carrying trays, interior decoration materials for electronic appliances, and various interior and exterior decoration materials; agricultural supplies such as seedling tools, fish packing boxes, and fruit packing boxes; and interior and exterior materials for transport facilities such as vehicles, aircrafts, and ships. By
virtue of being useful in universal purposes, the molded articles show wide industrial applicability.
What is claimed is:

1. A composition for molding articles, comprising: 90 parts by weight or less of grain powder as a base material and 20 parts by weight or less of compounds containing at least one component selected from the group consisting of hydroxyl (R-OH), ester (R-CO₂R’), carboxylic acid (R-CO₂H), amide (R-CONH-R’), imides (R-CONHCO-R’), amine (R-NH₂), anhydride (R-CO₂CO-R’), phosphonic acid (R-PO₃H₂), sulfonic acid (R-SO₃H) and melamine (wherein, R and R’ are independently H, aliphatic or aromatic organic compounds, or organic compounds containing the above-mentioned components) as a molding assistant.

2. The composition according to claim 1, wherein may further comprise 90 parts by weight or less of fibrous materials as a molding texture binders.

3. The composition according to claim 1, wherein may further comprise 90 parts by weight or less of functional improvers for molded articles.

4. The Composition according to any of claims 1 to 3, wherein the grain powder includes at least one selected from the group consisting of wheat flour, rice, starch, barley, and corn powder.

5. The composition according to claim 4, wherein the
grain powder is in the form of dough or liquid mixed with a small quantity of water.

6. The composition according to claims 2 or 3, wherein the fibrous materials include at least one selected from the group consisting of wormwood, reed, wheat straw, barley straw, rice straw, cotton and their debris.

7. The composition according to claim 3, wherein the functional improvers include at least one selected from stone powder, soil powder, fine sand powder and fine yellow earth powder.

8. A method for preparing a molded article, comprising the steps of:
   homogeneous mixing a composition according to any of claims 1 to 3;
   loading the composition on a molding machine; and
   molding the composition into an article for a predetermined period of time at a predetermined atmosphere.

9. The method according to claim 8, wherein the molding conditions include temperature of the range of 100-200 °C, pressure of the range of 200-400 kg/cm² and time of the range of several seconds to tens of seconds.
FIG. 1

FIG. 2

Start
Material Preparing \( \rightarrow \) S1
Coloring \( \rightarrow \) S2
Molding \( \rightarrow \) S3
Coating \( \rightarrow \) S4
End
INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER

IPC7 C08K 5/00

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)

Korean Patents and applications for inventions since 1975
Korean Utility models and applications for Utility models since 1975

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

IPC7 C08K 5/00, C08L 3/00, C08L 89/00, A01G 9/10

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>US-A-5,320,669 (IOWA STATE UNIVERSITY RESEARCH FOUNDATION, INC.) 14 Jun. 1994, see the claims</td>
<td>1, 3, 8, 9</td>
</tr>
<tr>
<td>X</td>
<td>JP-A-9-294482 (NIPPON SHOKUHIN KAKO CO., LTD.) 18, Nov. 1997 see the claims</td>
<td>1, 3, 4, 8, 9</td>
</tr>
<tr>
<td>A</td>
<td>JP-A-8-239402 (JAPAN CORN STARCH CO., LTD.) 17 Oct. 1996 see the claims</td>
<td>1 - 9</td>
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</table>

Further documents are listed in the continuation of Box C. See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

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"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

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"Y" document of particular relevance, the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

06 DECEMBER 2000 (06.12.2000)

Date of mailing of the international search report

08 DECEMBER 2000 (08.12.2000)

Name and mailing address of the ISA/KR

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