BOUND AGGREGATE COMPOSITION AND SUPPORT AND METHOD OF MAKING AND USING THE SAME TO SUPPORT FLOWERS.

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References cited:
AU-B-482 198
US-A-2 971 292
US-A-3 090 736

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Description

This invention relates to a bound aggregate, its method of manufacture, for supporting floral arrangements in containers for decorative purposes, transporting plants, cut flowers and for rooting of plants.

The floral industry distributes and sells fresh flowers made into arrangements for decorative purposes. These arrangements are made by professional designers trained in this art form. Originally, cut flowers were simply arranged in vases or containers filled with water. This caused problems in transporting the flowers from the shops to the consumers in that the arrangements were not held in place and became disarranged. The need to hold the flowers in an arranged manner resulted in the development of rigid floral foams for this purpose. These foams are made from polymer forming chemicals that, when added to the plant, cause the polymers to be formed thus causing foaming. These foams are rigid and must be shaped to fit the container. These foams are normally marketed in the form of blocks and the florist must cut these rigid foams to the required shape and size to fit in the containers. This results in waste scrap and requires time and work for shaping and sizing of the foam to fit the container and taping in place. In addition, since these foams are rigid, once the stem of a flower is inserted into the foam it cannot be removed and reinserted without leaving a hole where it was inserted.

Also, ground rigid foam and foam pellets have been used for supports for floral arrangements; however, this has not been satisfactory in that the floral arrangement easily shifts since good stable support is not provided.

Numerous materials, such as sand, dirt, rocks, etc. can be used to hold flowers rigidly in place; however, these are generally unsatisfactory for a variety of reasons.

Also, there are spillage problems with prior art floral supports. For example, a large number of funeral homes will not permit containers with water in their parlor due to spillage on expensive carpets.

US—A—2,971,292 to Malecki, issued February 14, 1961, discloses the use of various clays, alkali silicates and similar materials to form a support for fresh flowers. Products made from these materials and by the techniques described therein are unacceptable in the florist industry as all of these materials require vigorous mixing or kneading, they must be present in large amounts to provide support and tend to pack in place, they displace too much water in vases rather than holding water in an open structure of the particles thus providing inadequate water to the fresh flowers, they pack in such a manner to prevent easy insertion of fresh flowers and shift due to the lack of binding properties between the gel substance and other aggregates that are used with in conjunction with the gel. The support disclosed by this patent has never been marketed on any substantial scale.

US—A—3,973,355 to McKenzie, issued August 10, 1976, discloses a live plant growth mixture in which plant growth material is coated with water-insoluble, water-swappable, cross linked polymers and pressed and dried into a hard mass. When added to water in large quantities such as is necessary for fresh flower longevity, this material does not provide adequate support for floral arrangements and when added in very large ratios of material to water, there is inadequate water available for the flowers.

AU—B—482,198 (Union Carbide Corporation) discloses free-flowing, insoluble, hydrophilic polymers which are capable of absorbing many times their own weight of water. The polymers are suitable for inclusion, together with an inert filler, in plant substrate where the polymers are formed thus causing foaming. These foams are rigid and must be shaped to fit the container. These foams are normally marketed in the form of blocks and the florist must cut these rigid foams to the required shape and size to fit in the containers. This results in waste scrap and requires time and work for shaping and sizing of the foam to fit the container and taping in place. In addition, since these foams are rigid, once the stem of a flower is inserted into the foam it cannot be removed and reinserted without leaving a hole where it was inserted.

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Another form of the invention comprises a composition and its method of manufacture which is useful not only for a support for floral arrangements but also for transporting plants and cut flowers while maintaining them in good condition and for rooting plants.

The composition of the present invention comprises inert aggregate particles bound together when added to water by a water-insoluble, water-retaining binder, such as a particulate, water-insoluble, water-swellable, cross-linked polymer, the particles being present in an amount and having a bulk density and surface area effective to disperse the composition in water as the composition is added to it. Just enough binder should be present to bind the aggregate particles together. Excess binder reduces flower livability by restricting water take up by the fresh flowers. For most binders and aggregates, the binder is present in an amount of from about 0.1% to about 5.0% by weight, preferably about 1.0% by weight, with the remainder being the inert aggregate particles. Any desired coloring pigment, pH buffering agents, preservatives and plant nutrients and the like can be added as desired. For live cut flowers, preferably the composition should have an acidic pH, the lower limit being set so as not to break the bond of the binder. A satisfactory pH range in which the bond is not broken is from about 5.5 to about 8.5 which provides good livability of most flowers, except roses which prefer a more acidic pH of about 3.0 to 3.5. The composition is simply added to water in which it disperses throughout and forms a firmly bound water aggregate. Good results are obtained by simply adding the composition to water in a container until such time as a composition is formed with the water into a bound solid mass, at which time a small additional amount of the composition is placed on the surface and generally pressed down to form the finished composition. For most materials about 0.2 kg of the composition is present for each kilogram of the water in the container; although, it is unnecessary to measure the amount of composition placed in the water which greatly simplifies the formation of the desired end product.

The binders, that is bridging and holding materials, include the water-swellable polymers, which include any cross-linked species of a polymer whose linear analog is water-soluble. Typical of such materials are cross-linked monovalent cation salts of polyacrylic, polymethacrylic, polyvinylmethacrylate, polyvinyl alcohol and polyvinyl acid and of acrylamide and acrylic acid and of acrylamide and the monovalent salts of acrylic acid; cross-linked heterocyclic monomers, such as polyvinyl morpholinone, poly-5-methyl-N-vinyl-2-oxazolidinone and polyvinyl pyrrolidone; other cross-linked water-swellable but water-insoluble polymers or copolymers can also be employed.

Such materials as the above-named polymers can be made by a variety of known methods. For example, the substantially water-insoluble, water-swellable, cross-linked polyacrylate salts may be prepared by chemical cross-linking as shown in GB—A—719,330, or, alternatively, by subjecting a mixture of a monovalent cation salt of acrylic acid and natrium to the influences of high energy ionizing radiation for a period of time sufficient to effect the desired polymerization and the cross-linking of at least a portion of the polymer produced. In the latter instance, the amount of ionizing radiation should be at least about 0.5 megarad but greater or lesser amounts may be employed. In any event, the amount of radiation must be great enough to give a swelvable polymer which takes in water or aqueous solutions and, in so doing, increases in volume but generally retains its original shape. With this class of polymeric materials, it is critical to the present invention that the salt-forming cation be monovalent. Representative examples of monovalent cations include, for example, the alkali metals, that is, sodium, potassium, lithium, rubidium and cesium, we well as water-soluble ammonium-like radicals based upon the quaternary nitrogen atom.

Other methods for preparing such crosslinked materials may be found in US—A—2,810,716, issued Oct. 22, 1957, to Markus. The acrylamide polymers and copolymers may be chemically cross-linked, in addition to the materials disclosed in that patent, with methylenebisacrylamide as the cross-linker.

For a further description of such water-insoluble, water-swellable polymers reference is made to US—A—3,090,736 to R. N. Bashaw et al., issued May 21, 1963 and US—A—3,229,769 to Robert N. Bashaw issued January 18, 1966. If desired any water-insoluble or substantially water-insoluble adhesive can be used in an amount sufficient to coat the particles of the mix, such as is disclosed in the art.

These polymers differ from water-soluble polymers such as methylcellulose, casein, sodium alginate, locust bean and the natural gums in that the latter form viscous liquids in low concentrations. These polymers also differ markedly from colloid forming clays such as attapulgite, bentonite and others in that the clays simply swell, have very limited ability to stretch throughout water and have little or no ability to serve as a binder for other aggregates in the presence of large quantities of water. Accordingly, these polymers are not easily
leached out by repeated watering of the plants and continue to act as binders for the other portions of the mix in water over a long period of time. Advantageously, they also increase the water retention capacity of the mix considerably.

Presently preferred polymers are a hydrolyzed starch-acrylonitrile graft co-polymer, which is manufactured and marketed by General Mills; and Norbak, a Trade Mark for a polyacrylamide potassium salt, a polymer of high gel capacity, which is manufactured and marketed by Dow Chemical Company.

Any water-insoluble, water-retaining, highly expandable gel forming polymer or other binder which holds in place aggregates having a large amount of open structure are satisfactory and thus forms an ideal medium for uses in floral design holder, for example, fibrous cellulose. Any water-insoluble binder having water retention properties in excess of about 100 grams per gram is highly satisfactory for use in the composition and method of the invention.

Any inert aggregate particles can be used which have open structures resulting in high water holding capabilities, at least 4 g of water per gram of aggregate, a surface area of at least about 10 m²/g and an apparent bulk density of not over about 480 kg/m³ to avoid packing. These include rice hull ash, ground silica gel, ground aluminum hydrogel, silica alumina cracking catalyst (as used in the petroleum industry), expanded mica, expanded pearlite, aluminum oxide, and silica which have the foregoing water-retention properties and surface area. The presently preferred aggregate is whole rice hull ash which is essentially the silicon skeleton of rice hulls and hence has a large amount of open structure with high water holding properties and which is heavy enough to sink in water and is available at relatively low cost. Some of the foregoing aggregates tend to float and initially need to be pushed down into the water, but they then stay under the water and disperse throughout it; for example, ground rice hull ash, expanded pearlite and expanded mica.

Any suitable coloring pigments or agents which will not break the bond of the binder can be included, which include oxides of chromium, iron, copper, manganese and similar materials used as pigments.

The pH of the composition may be adjusted by the addition of boric acid in amounts of about 1% by weight. Also small amounts of mineral acids such as H₂SO₄ or HNO₃ and organic acids such as acetic or citric acid can be used.

A flower preservative can be added if desired. These flower preservatives are essentially sucrose with a small amount of bacterial growth retardant added. The preferred flower preservative contains 1% sucrose as a mixture of sucrose and hemicellulose extract plus .01 percent 8-hydroxyquinoline citrate to prevent bacterial growth and plugging of the flower stems.

Small amounts of plant nutrients can be added, if desired. For a suitable list of plant nutrients and other agricultural chemicals which can be added to the composition, reference is made to US—A—3,973,385 to McKenzie, issued August 10, 1976 and to the other patents referenced herein.

The methods of the invention comprise mixing the binder, such as the polymer or co-polymer, with the aggregate, including any coloring agents, buffering pH agents, floral preservatives, nutrients and the like as desired, in proportions previously set forth. These are mixed dry in the proportions previously set forth in a mixer, such as a ribbon blender. The composition is then added to a vase or other container having water in it from about 60% by weight to about 80% of the desired final level. The composition is added to the water slowly, allowing the composition particles to disperse through the water. The composition is continued to be added until the solid particles are slightly above the water level.

No mixing, stirring or hand kneading is required or needed when the aggregate is or has the properties of rice hull ash; although, some of the other aggregates may need to be pressed down gently into the water. The composition is then pressed and firmed, such as with the fingers, or a flat object such as a trowel. If a firmer support is desired, additional small amounts of the composition are added and the composition is pressed again. This is repeated until the desired firmness is achieved. This provides a firm floral support with good availability of water to the plants and an increase in volume of only about 20%. The flowers and other floral decorations, such as cut flowers, dried flowers, artificial flowers, ferns, candles and the like, are added by inserting portions of them into the support until the floral decoration has been made. During the arranging of the floral components of the floral decoration, if desired the stems of flowers, ferns or portions of the floral decorations can be removed, the opening left by the removal pressed back into place as a solid and these members reinserted where desired. The composition keeps the finished design in place for days and, in the case of fresh flowers, maintains the fresh flowers fresh and alive for days.

When it is ready to discard the display, the floral components can simply be removed, the container can be flushed with warm water to thereby remove the gel particles so that the container can be used again for other floral arrangements. If desired, the gel particles can be saved, dried and reused as previously described.

Example 1

In this example water was added to a florist vase in an amount to fill approximately 75 percent of the vase. A dry composition comprising 99 percent by weight rice hull ash and 1 percent by weight hydrolyzed starch-acrylonitrile
graft copolymer (SGP-5025) obtained from General Mills, was added as described previously. This resulted in the final mix containing about 0.2 kg of the composition for each kilogram of water. The resulting bound water aggregate was firm without any free water apparent yet contained about 75% to 80% by weight water thus providing good water supply to fresh flowers. The stems of various fresh cut flowers were then inserted into the mixture in a floral arrangement. The flowers added were:

1. Daisy
2. Pixie Carnation
3. Cushion Pom
4. Jackstraw
5. Fuji Mum

The bound water aggregate composition held the flowers firmly in place. The flowers maintained their beauty and livability for approximately 7 to 9 days. The arrangement was readily transportable without any spillage or slippage of the flora arrangement.

Example 2

This example is the same as Example 1 except that the SGP-5025 polymer was increased to approximately 5% by weight level. The results obtained were the same as in Example 1 except that the livability of the flowers was reduced to about four days. This is apparently due to the gel thickness being too great for easy water uptake by the flowers.

When the pH of the mixture was quite acidic (below pH 4.0) or basic (above pH 8.5) the flower lifetime of the above listed flowers was decreased. Also, above pH 8.5, a mold formed on the surface of the floral support.

Example 3

In this example the composition comprised a series of mixtures of ground silica gel, ground alumina hydrogel, silica alumina cracking catalyst (as used in petroleum industry), fly ash, and aluminum oxide, with fibrous cellulose and with Norbak in the amounts of from 95 to 99% by weight aggregate and 1% to 5% by weight binders. These compositions were added to water and flowers were inserted in the bound aggregate as indicated in Examples 1 and 2 with results similar to those of Examples 1 and 2.

Example 4

In this example, three formula variations were studied using cut flower life in each formula as the response. Flowers were considered to have expired when their appearance was slightly wilted thus rendering them unsaleable.

<table>
<thead>
<tr>
<th>Formula I</th>
<th>Percent by Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rice Hull Ash</td>
<td>99.5%</td>
</tr>
<tr>
<td>SGP polymer</td>
<td>.5%</td>
</tr>
</tbody>
</table>

Tap water was added to three identical florist vases in an amount to fill about 75% of the vase. Each of the above formulas were added into the water in each of the vases, one formula per vase until there was no apparent free water. The volume expansion in each of the vases was approximately 15%. An equal number and variety of fresh flowers were then inserted into the formulas and the vases placed side by side on a table for visual observation. Flowers used in the test included carnations, daisys, mums and roses. All of the roses expired after one day. All of the other flowers remained fresh in each of the three formulas for 5 days. On the 6th day the flowers in formula II were deemed unsaleable. On the 8th day, the carnations and mums in Formulas I and III were deemed unsaleable but the daisys were still fresh enough to be sold. The test was then terminated.

While the present invention is especially suitable for floral arrangements, it can be used for other purposes such as transporting plants, cut flowers, or for rooting of plants. The composition is formed with the required pH properties for the plants and the stems or roots of the plant are inserted into the formed bound aggregate composition. This is particularly important and suitable for transporting plants from one country into another country as it avoids problems with the bringing of plants into a country in dirt with possible disease, plant insects, and the like.

Claims

1. A composition comprising a particulate, water-insoluble, water-retaining binder and inert aggregate particles dispersed throughout the binder, the particles having an apparent bulk density of not more than about 480 kg/m³ and a surface area of at least about 10 m²/g and being present in an amount effective to disperse the composition in water as the composition is added to water without mixing and to provide a firmly bound aggregate support with the water comprising about 80% to 90% by weight of water, characterized in that said binder is a water-insoluble, water-swellable, cross-linked polymer present in the composition in an amount of from about 0.1% to about 5.0% by weight and having water retention properties of at least 100 g/g.

2. A composition as claimed in claim 1, characterized in that the aggregate is rice hull ash.
3. A composition as claimed in claim 2, characterised in that the aggregate is rice hull ash and is present in the composition in an amount of about 99% by weight.

4. A composition as claimed in any one of claims 1 to 3, characterised in that the binder is a starch-acrylonitrile graft copolymer.

A composition as claimed in any one of claims 1 to 4, characterised in that the composition has a pH from about 5.5 to about 8.5.

5. A bound water aggregate support having the property of being able to firmly support flowers whose stems are inserted therein and to provide water thereto, characterised by the composition as claimed in any one of claims 1 to 5, wherein the composition is dispersed throughout and forms a bound aggregate with the water.

6. A method of forming a bound water aggregate support capable of supporting flowers whose stems are inserted therein and providing water thereto, characterised by adding the composition claimed in any one of claims 1 to 5 into water in a container in an amount sufficient to form the bound water aggregate support.

7. A method as claimed in claim 8 characterised in that about 0.2 kg of the composition of any one of claims 1 to 5 is added for each kg present in the container.

8. A method of making a floral arrangement, characterised by performing the steps as claimed in claim 8 or 9, and inserting stems of the flowers into the bound water aggregate support.

10. A method of transporting plants, cut flowers or for rooting of plants, characterised by inserting the stems thereof into the support as claimed in claim 6.

**Revendications**

1. Composition comprenant un liant particulaire, insoluble dans l'eau, ayant un pouvoir de rétention vis-à-vis de l'eau, ainsi que des particules d'agrégat dispersées dans le corps du liant, ces particules ayant une densité apparente qui n'est pas supérieure à environ 480 kg/m³ et une superficie d'au moins environ 10 m²/g, et étant présentes en une quantité suffisante pour disperser la composition dans l'eau sans action de mélange et pour donner avec l'eau un support formé par agrégation fermement lié avec l'eau, comprenant un proportion d'eau comprise entre environ 80 et 80% en poids, caractérisée en ce que le liant est un polymère réticulé insoluble dans l'eau gonflant dans l'eau, présent dans la composition en une quantité comprise entre environ 0,1% et environ 5,0% en poids et dont le pouvoir de rétention d'eau s'élève au moins 100 g/g.

2. Composition selon la revendication 1, caractérisée en ce que l'agrégat est de la cendre de coquille de riz.

3. Composition selon la revendication 2, caractérisée en ce que l'agrégat est de la cendre de coquille de riz et est présent dans la composition en une quantité d'environ 99% en poids.

4. Composition selon l'une quelconque des revendications 1 à 3, caractérisée en ce que le liant est un copolymère greffé d'amidon et d'acrylonitrile.

5. Composition selon l'une quelconque des revendications 1 à 4, caractérisée en ce que le pH de la composition est compris entre environ 5,5 et environ 8,5.

6. Support formé d'agrégats liés au moyen d'eau présentant la propriété d'être susceptible de former un support solide pour les fleurs dont les tiges sont plantées dans ce support et de leur fournir de l'eau, caractérisé en ce qu'il est constitué par une composition définie dans l'une quelconque des revendications 1 à 5, la composition dans ce support étant dispersée dans l'eau qui assure la liaison entre les agrégats.

7. Procédé de fabrication d'un support formé d'agrégats liés au moyen d'eau susceptible de former un support pour les fleurs dont les tiges sont plantées dans ce support et de leur fournir de l'eau, caractérisé en ce qu'on ajoute la composition définie dans l'une quelconque des revendications 1 à 5 à de l'eau dans un récipient en une quantité suffisante pour former le support composé d'agrégats liés au moyen d'eau.

8. Procédé selon la revendication 7, caractérisé en ce qu'environ 0,2 kg de la composition selon l'une quelconque des revendications 1 à 5 est ajouté par kg présent dans le récipient.

9. Procédé pour faire un arrangement floral, caractérisé en ce qu'on effectue les stades définis dans les revendications 7 ou 9 et en ce qu'on place les tiges des fleurs dans le support formé d'agrégats liés au moyen d'eau.

10. Procédé pour transporter des plantes, des fleurs coupées ou pour faire prendre racine à des plantes, caractérisé en ce qu'on plante les tiges de celles-ci dans un support défini dans la revendication 6.

**Patentansprüche**

1. Mischung aus einem teichnenförmigen, wasserunlöslichen, das Wasser haltenden Binder und inerten Aggregat-Teilchen, die im gesamten Binder verteilt sind, wobei die Teilchen eine schwellbare Schüttstoffe von höchstens etwa 480 kg/m³ und eine spezifische Oberfläche von mindestens etwa 10 m²/g aufweisen und in einer Menge vorliegen, die es ermöglicht, die Mischung bei Zugabe zu Wasser ohne Mischen zu dispergieren und mit dem Wasser einen fest gebundenen Aggregat-Träger mit etwa 60 bis 80 Gew.-% Wasser zu bilden, dadurch gekennzeichnet, daß der Binder ein wasserunlösliches, in Wasser quellbares, quer- vernetztes Polymer ist, das in der Mischung in einer Menge von etwa 0,1 bis etwa 5,0 Gew.-% vorliegt und ein Wasser-Rückhaltevermögen von mindestens 100 g/g besitzt.
2. Mischung nach Anspruch 1, dadurch gekennzeichnet, daß das Aggregat Reishülsenachse ist.
4. Mischung nach einem der Ansprüche 1 bis 3, dadurch gekennzeichnet, daß der Binder ein Stärke-Acrylnitril-Propylypropylene Polymer ist.
5. Mischung nach einem der Ansprüche 1 bis 4, dadurch gekennzeichnet, daß die Mischung einen pH-Wert von etwa 5,5 bis etwa 8,5 hat.
6. Aggregat-Träger mit gebundenem Wasser mit der Eigenschaft, Blumen, deren Stengel darin eingeführt sind, fest zu halten und ihnen Wasser zuzuführen, gekennzeichnet durch das Vorliegen der Mischung nach einem der Ansprüche 1 bis 5, wobei die Mischung in Wasser homogen verteilt ist und mit diesem ein gebundenes Aggregat bildet.
7. Verfahren zur Bildung eines Aggregat-Trägers mit gegundenem Wasser, der imstande ist, Blumen, deren Stengel darin eingeführt sind, fest zu halten und ihnen Wasser zuzuführen, dadurch gekennzeichnet, daß die in einem der Ansprüche 1 bis 5 beanspruchte Mischung in einem Behälter einer genügenden Menge Wasser zugesetzt wird, um den Aggregat-Träger mit gebundenem Wasser zu bilden.
8. Verfahren nach Anspruch 8, dadurch gekennzeichnet, daß etwa 0,2 kg der Mischung nach einem der Ansprüche 1 bis 5 je kg Aggregat-Träger in dem Behälter zugesetzt werden.