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(54) Title: A COMPOSITION AND USES THEREOF

(57) Abstract: The present invention provides a composition including water, a hydrocolloid and a cross-linking agent. Also provided are methods of using the composition of the present invention to insulate at least a portion of an article from an effect arising from a change in ambient temperature. Also provided are methods of using the composition of the present invention to irrigate an area of soil or other suitable agricultural medium.

A COMPOSITION AND USES THEREOF

The present invention relates to a composition, more specifically, to an insulating film forming composition and methods for its preparation and use.

BACKGROUND

Physical damage to articles arising from their exposure to the surrounding elements can be inconvenient and problematic. Such damage can also lead to significant economic losses. For example, growers of high-value commercial crops such as grapes, citrus (*e.g.* oranges, lemons, limes and grapefruit), apples, peaches, strawberries, almonds and tobacco are acutely aware of the potentially devastating damage to their crops caused by frost. The practices adopted by commercial growers to limit the damage caused by frost can be segregated into *passive* and *active* methods.

Passive methods typically include selecting a planting site where there is no or minimal frost risk. For instance, closed valleys can trap cold air and create a thick frost zone while open plains tend to thin the frost layer. Where radiation frosts are common, planting sites should be designed so that cold air can be drawn away from the crops. Barriers to airflow include windbreaks, plantations, trees along creek lines, dam banks and buildings. Fog can often be a good indicator of areas where radiation frosts may be a problem.

Site selection may also be guided by knowledge of soil types. Typically, dark soils absorb more heat than light soils, while gravelly soils absorb more heat than clay soils. A compact, bare, moist soil can store solar heat radiation during the day and re-radiate this heat during the night a lot better than freshly cultivated soils or those soils planted with cover crops. Although cover crops offer many benefits to the plants, their retention into the spring period can pose a frost risk to plants because dense cover crop has the potential to reduce night time temperatures by up to 5 to 6°C, further adding to the risk of frost damage.

Passive methods may also include planting cold-tolerant crop varieties. For instance, earlier bursting grape varieties such as chardonnay and pinot noir are more likely to be

affected by frosts than later bursting varieties such as cabernet sauvignon. Some grape varieties will also recover better after a spring frost than other varieties (*e.g.* gamay).

Passive methods may also include floor management techniques, as there is a greater risk of frost damage the closer the food crops are to the ground. Trellising systems can therefore be used to raise the crop further from the ground.

Pruning methods have also been applied to reduce the risk of frost damage. For instance, the earliest bursting varieties (i.e. the most susceptible to frost damage) are typically pruned last. However, on a large commercial scale or where there is a labour or machinery shortage, delayed pruning practices may be difficult to implement to be of benefit.

By contrast, *active* methods seek to replace or prevent radiant heat loss by using methods requiring outside energy when commercial crops are threatened by frost or changes in ambient temperature. These methods include:

(i) *overhead sprinkler irrigation* – this provides frost protection by releasing of latent heat. However, overhead irrigation is problematic, not only because of the increased amount of water use (particularly in times of drought), but it can also lead to waterlogging and poor soil drainage. In the most part, dam capacity and annual rainfall must be considered if using overhead sprinkler irrigation for frost prevention;

(ii) *Air mixing* - frosts typically include an inversion layer that contains warmer and usually drier air than that found closer to the soil surface. If no or insufficient breeze is present, man made machines such as wind machines or helicopters may be used to mix the air. However, noise pollution, especially in built up areas, needs to be considered, as well as the power consumption;

(iii) *Fuel burning* - Burning fuels can be an effective means of frost prevention, which is said to be attributed to the generation of heat as well as the insulating layer of smoke that collects in the inversion layer of radiant frost. However, if the fire is too strong it could actually produce a strong draught of

heated air that could break through the inversion layer of the radiant frost and ascend to a height of no benefit. Carbon emissions are also of concern with this type of method; and

(iv) *Physical coverings* - Physical coverings such as greenhouses and netting have also been reported as providing some protection against frost damage. However, this type of active protection would only be suitable on small plantings.

Thus, whilst the passive and active protection methods may provide some relief against crop damage arising from frost, they have associated with them inherent limitations and problems, as hereinbefore described.

Frost can also present a significant problem to articles other than plants or plant food. For instance, where a motor vehicle has been exposed to ambient freezing temperatures (*e.g.*, at or below 0°C), the vehicle typically becomes covered with a layer of ice that can obscure the driver's view, particularly when found covering the vehicle's windows. This makes the vehicle particularly dangerous to drive in such a state. However, removing the layer of ice can be difficult. Current methods employed for this purpose involve chipping away at the layer of ice, although this can irreparably damage the underlying surface, particularly where the surface is made of glass. Another method that is used to remove the layer of ice from a vehicle involves melting the layer of ice away from the vehicle by pouring heated water over the affected area. However, this also poses a risk to the vehicle because the application of heated water onto a frozen surface such as glass can lead to the glass breaking.

A further example of where exposure to the surrounding elements can lead to significant economic losses relates to fires. With current fire-fighting methodologies, when ordinary water is sprayed onto inflamed articles to extinguish the fire, the remaining water on the kindling will begin to flow to the ground and/or evaporate as a result of the surrounding heat. The loss of water, for example, by evaporation, therefore exposes the kindling to the surrounding heat, and as a result, the kindling becomes prone to catching fire again. For this reason, water is generally a poor fire retardant.

The present invention has also been found to overcome, or at least partly alleviate some of the aforementioned problems of the art by providing a composition that is capable of forming an insulating film on an article to which it has been applied, thus minimizing damage that may arise from exposure to the elements (*e.g.*, changes in ambient temperature, including frost and excessive heat, dust, moisture).

For the purposes of brevity, the following description will be limited to discussions relating to the application of such compositions in the fields of plant agricultural and fire fighting. However, it will be appreciated that the composition of the present invention will have broader utility in other fields where protection of an article from the surrounding elements may be beneficial.

The discussion of documents, acts, materials, devices, articles and the like is included in this specification solely for the purpose of providing a context for the present invention. It is not suggested or represented that any or all of these matters formed part of the prior art base or were common general knowledge in the field relevant to the present invention before the priority date of each claim of this application.

SUMMARY OF THE INVENTION

In a first aspect, the present invention provides a composition including water, a hydrocolloid and a cross-linking agent.

In one embodiment, the hydrocolloid is selected from the group consisting of gelatin, starch, carrageenans, guar, locust, tara, Arabic gum, ghatti gum, agar gum, xanthan gum, pectin, gelatin, alginate or an alginic acid derivative, pectin or a pectin derivative, polyvinylpyrrolidone, a carboxyvinyl polymer, a polyethylene oxide polymer, carboxymethyl cellulose, methyl cellulose, hydroxypropyl cellulose, hydroxypropyl methyl cellulose, and any combination thereof. In a certain embodiment, the hydrocolloid is carboxylmethyl cellulose (CMC). In another embodiment, the hydrocolloid is alginate or an alginic acid derivative, including, but not limited to, calcium alginate, polypropylene alginate, potassium alginate, propylene glycol alginate, propylene glycol alginate and sodium alginate, and mixtures thereof. In a certain embodiment, the alginate is sodium alginate.

In another embodiment of the present invention, the cross-linking agent is selected from the group consisting of calcium chloride, magnesium chloride, aluminium chloride, potassium sulphate, aluminium sulphate and aluminium potassium sulphate, and any combination thereof. In one embodiment, the cross-linking agent is potassium sulphate and/or aluminium potassium sulphate.

The composition according to the present invention may further include gelatin. The composition according to the present invention may also include a preservative, such as potassium citrate and/or sodium benzoate.

In another embodiment, the composition according to the present invention has a viscosity of at least 500 centipoise at ambient temperature. In yet another embodiment, the composition according to the present invention has a liquid viscosity of at least 2000 centipoise at ambient temperature.

In another aspect of the present invention, there is provided a method of producing a composition, the method including the steps of:

(a) combining a hydrocolloid with water to provide a first mixture;

(b) agitating the first mixture so as to form a second mixture having greater liquid viscosity than the first mixture; and

(c) mixing the second mixture with a cross-linking agent so as to produce a final composition.

The present invention also provides a composition produced by a method as herein described.

In yet another aspect of the present invention, there is provided a method of retarding a fire, the method including the step of applying to the fire the composition as herein described.

In another aspect of the present invention, there is provided a method of preventing a fire on an article, the method including the step of applying to the article the composition as herein described.

In yet another aspect of the present invention, there is provided a method of insulating at least a portion of an article from an effect arising from a change in ambient

temperature, the method including applying to a surface of the article the composition according to the present invention, as herein described. In one embodiment, the method of the present invention is particularly applicable to plants and/or plant foods that are susceptible to frost damage, including, but not limited to, fruits, vegetables legumes and the like.

For a better understanding of the present invention, its operating advantages and the specific aspects of its use(s), reference shall now be made to the accompanying drawings and descriptive matter in which there are illustrated preferred embodiments of the present invention.

Thus, the foregoing is considered as illustrative only of the principles of the present invention. Further, since numerous modifications and changes will readily occur to those skilled in the art, it is not desired to limit the invention to the exact construction and operation shown and described, and accordingly, all suitable modifications and equivalents may be resorted to, falling within the scope of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

Compositions

In a first aspect, the present invention provides a composition including water, a hydrocolloid and a cross-linking agent.

It has been found that the composition of the present invention is capable of forming a film on the surface of an article to which it has been applied. Moreover, the film is capable of insulating the article from the elements to which it is normally exposed, including, but not limited to, dust, moisture and changes in ambient temperature (*e.g.*, frost and/or heat)

The term "*film forming*", as used herein, refers to a composition that is capable of forming a film or membrane on the surface of an article to which it has been applied. The density of the film or membrane that forms on the article to which the composition has been applied will depend on a number of factors, including, but not limited to, the ambient temperature, the temperature of the article to which it is being applied, the

temperature of the composition immediately prior to application, the level of humidity in the atmosphere surrounding the articles to which the composition will be applied and the concentration of hydrocolloid and/or cross-linking agent in the composition. It will be appreciated by the skilled addressee that the density of the film or membrane may be altered by changing any one or more of these factors.

A "*hydrocolloid*", as used herein, is a substance that is capable of forming a gel in water. Hydrocolloids useful in the present invention include natural, semi-synthetic, and synthetic hydrocolloids. The hydrocolloid can include, for example, natural seaweed extract, natural seed gum, natural plant exudates, natural plant extracts, natural fiber extracts, biosynthetic gums, gelatins, biosynthetic process starch or cellulosic materials, alginates, carrageenans, guar, locust, tara, Arabic gum, ghatti gum, agar gum, xanthan gum, pectin, other like hydrocolloid source material or combinations thereof.

In one embodiment of the present invention, the hydrocolloid is selected from the group consisting of gelatin, starch, carrageenans, guar, locust, tara, Arabic gum, ghatti gum, agar gum, xanthan gum, pectin, gelatin, alginate or an alginic acid derivative, pectin or a pectin derivative, polyvinylpyrrolidone, a carboxyvinyl polymer, a polyethylene oxide polymer, carboxymethyl cellulose, methyl cellulose, hydroxypropyl cellulose, hydroxypropyl methyl cellulose, and any combination thereof. In one embodiment, the hydrocolloid is carboxylmethyl cellulose (CMC).

The amount of hydrocolloid used in the composition of the present invention will depend upon the required viscosity of the composition and/or the required density of the film or membrane that is to form on the surface of the article to which the composition has been applied. For example, it would be understood by those skilled in the art that the greater the concentration of hydrocolloid in the composition, the greater the viscosity of that composition. The required amount of hydrocolloid can be determined by any means known to the skilled person. However, in a certain embodiment, the hydrocolloid is present in the composition of the present invention at from about 0.01% to about 5% by weight of the total weight of the composition. In another embodiment, the hydrocolloid is present at from about 0.01% to about 0.3% by weight of the total weight of the composition. In yet another embodiment, the hydrocolloid is present at from about 0.01% to about 0.2% by weight of the total weight of the composition.

In another embodiment of the present invention, the hydrocolloid is carboxylmethyl cellulose (CMC). The CMC may be used in the composition of the present invention at from about 0.5% to about 5.0% CMC by weight of the total weight of the composition.

The composition may contain CMC as the only hydrocolloid, or it may be used in combination with any number of other hydrocolloids as herein described, including, but not limited to, sodium alginate and/or gelatin. Thus, in another embodiment of the present invention, the composition includes a combination of (i) CMC and sodium alginate, (ii) CMC and gelatin or (iii) CMC, sodium alginate and gelatin.

In one embodiment of the present invention, the hydrocolloid is alginate or an alginic acid derivative including, but not limited to calcium alginate, polypropylene alginate, potassium alginate, propylene glycol alginate, propylene glycol alginate and sodium alginate, and any combination thereof.

Alginate (the salt of alginic acid) is a biodegradable polysaccharide with mannuronic and glucoronic acid repeating units, principally extracted from the giant kelp *Macrocystis pyrifera*. It is usually present as a mixed salt (sodium, potassium, calcium, magnesium) of alginic acid and aqueous solutions of alginate form gels when mixed with divalent cations (*e.g.*, calcium salts). In one embodiment, the hydrocolloid is sodium alginate, the sodium salt of alginic acid. The composition of the present invention may include sodium alginate at from about 0.01% to about 1.0% by weight of the total weight of the composition.

The composition may include sodium alginate as the only hydrocolloid, or it may be used in combination with any number of other hydrocolloids as herein described, including, but not limited to, CMC and/or gelatin. Thus, in another embodiment of the present invention, the composition includes a combination of (i) sodium alginate and CMC, (ii) sodium alginate and gelatin or (iii) sodium alginate, gelatin and CMC.

In yet another embodiment of the present invention, the composition includes CMC at from about 0.5% to about 5.0% CMC by weight of the total weight of the composition and sodium alginate at from about 0.01% to about 1.0% by weight of the total weight of the composition, (ii) CMC at from about 0.5% to about 5.0% CMC by weight of the total weight of the composition and gelatin at from about 0.001% to about 0.02% by weight

of the total weight of the composition, or (iii) CMC at from about 0.5% to about 5.0% CMC by weight of the total weight of the composition, sodium alginate at from about 0.01% to about 1.0% by weight of the total weight of the composition and gelatin at from about 0.001% to about 0.02% by weight of the total weight of the composition.

In yet another embodiment of the present invention, the hydrocolloid is gelatin or a derivative thereof. Gelatin is an almost colourless, water-soluble glutinous protein typically obtained by the partial hydrolysis of collagen extracted from the connective tissue of animal, such as bone and skin. In aqueous solution, gelatin forms a semi-solid colloid gel, resulting in a solution of higher viscosity than water. The solubility of the gelatin is typically determined by its method of manufacture. For instance, gelatin can be dispersed in a relatively concentrated acid and such dispersions are suitable for coating purposes or for extrusion into a precipitating bath. Gelatin is also soluble in most polar solvents. Gelatin gels exist over only a small temperature range. The upper limit of that range is typically the melting point of the gelatinous gel, which depends on gelatin grade and concentration. The lower limit of the temperature range is typically the point at which ice crystallizes out of the gelatin solution. Thus, the concentration of gelatin in the composition of the present invention and the temperature at which the composition is to be used will determine the viscosity of the composition (*e.g.*, the higher the concentration of gelatin, the greater the viscosity of the composition). In one embodiment, the composition of the present invention includes gelatin at from about 0.001% to about 0.02% by weight of the total weight of the composition. In another embodiment, the composition of the present invention includes gelatin at from about 0.005% to about 0.075% by weight of the total weight of the composition.

The composition of the present invention may include gelatin as the only hydrocolloid, or it may be used in combination with any number of other hydrocolloids, including, but not limited to, CMC and/or sodium alginate, as herein described. Thus, in another embodiment of the present invention, the composition includes a combination of (i) gelatin and CMC, (ii) gelatin and sodium alginate or (iii) gelatin, sodium alginate and CMC.

As hereinbefore described, the required amount of hydrocolloid can be determined by any means known to the skilled person. For example, in one embodiment, the hydrocolloid is present in the composition of the present invention at from about 0.01%

to about 5% by weight of the total weight of the composition. In another embodiment, the hydrocolloid is present in the composition at from about 0.01% to about 0.3% by weight of the total weight of the composition, or at from about 0.01% to about 0.2% by weight of the total weight of the composition.

The amount of hydrocolloid used in the composition of the present invention will typically determine the viscosity of the composition. The viscosity of the composition can be determined by any means known in the art, including, but not limited to using a long-run glass tube viscometer, a vibrating viscometer and a rotation viscometer. In one embodiment, the composition will have a viscosity of at least 500 centipoise at ambient temperature. In yet another embodiment, the composition according to the present invention will have a viscosity of at least 2000 centipoise at ambient temperature.

The composition according to the present invention also includes a cross-linking agent, which acts in part to facilitate the cross-linking of the hydrocolloid particles in the composition and thereby facilitate the formation of an insulating film or membrane on the surface of an article to which the composition has been applied.

The cross-linking agent may be any cross-linking agent known in the art, including, but not limited to, calcium chloride, magnesium chloride, aluminium chloride, potassium sulphate, aluminium sulphate and aluminium potassium sulphate, and any combination thereof. In a certain embodiment, the cross-linking agent is potassium sulphate and/or aluminium potassium sulphate. In one embodiment of the present invention, the composition includes from about 0.01% to about 2.0% potassium sulphate by weight of the total weight of the composition and/or from about 0.01% to about 2.0% aluminium potassium sulphate by weight of the total weight of the composition.

The constituents of the composition, as herein described, will typically be present in amounts that will allow for the formation of an insulating film on the surface of the article to which the composition has been applied. This can be determined by the skilled addressee by any means known in the art, for instance, by trial and error (*i.e.*, applying the composition to an article and determining whether an insulating film is subsequently formed on the surface of that article). In a certain embodiment, the composition according to the present invention includes, per weight of total composition:

(a) from about 0.5% to about 2.0% w/w of CMC;
(b) from about 0.001% to about 0.02% w/w of gelatin;
(c) from about 0.01% to about 1.0% w/w of sodium alginate;
(d) from about 0.01% to about 2.0% w/w of potassium sulphate; and
(e) from about 0.01% to about 2.0% w/w of aluminium potassium sulphate.

In yet another embodiment, the composition according to the present invention includes, per weight of total composition:

(a) from about 0.95% to about 1.5% w/w of CMC;
(b) from about 0.005% to about 0.075% w/w of gelatin;
(c) from about 0.045% to about 0.0675% w/w of sodium alginate;
(d) from about 0.07% to about 0.2% w/w of potassium sulphate; and
(e) from about 0.03% to about 0.07% w/w of aluminium potassium sulphate.

In another embodiment, the film-forming composition of the present invention includes any other additive, including, but not limited to, a flavouring, a sweetener, a dye or pigment, a pesticide, a herbicide, an opacifier, such as talc, a lubricant, such as magnesium stearate, a mineral oil, a lecithin or carnauba wax, a water-repelling agent, such as fatty acids and their derivatives, or silicone polymers, a wetting agent, such as surface-active agents, surfactants, such as polysorbate 80, an agent for improving the adhesion of the film, such as microcrystalline cellulose, polyols, maltodextrins, polydextrose or lactose, a preservative such as, in particular, sodium citrate, release agents, such as polyethylene glycol 3350, lecithin, stearic acid, talc or microcrystalline cellulose, an aqueous solvent such as methanol, ethanol, butanol, methylene chloride or acetone, or active substance such as a pharmaceutical active substance, or any combination thereof.

A dye or pigment, for example, may be useful to ascertain the degree of coating when the composition is applied to an article. For instance, it may be advantageous to ensure that the surface of a food crop (*e.g.*, stone fruit) is substantially coated so as to minimize the surface area that may be exposed to changes in ambient temperature (*e.g.*, frost). By using a dye such as an edible food dye in the composition of the present invention, one may ascertain whether the surface of the food crop is adequately coated. The dye used will typically be of a colour that provides a degree of contrast to the colour of the food crop (*e.g.*, red or blue dye). The amount of dye used

in the composition can be ascertained by the skilled person, for example, on the basis of the final colour to be achieved on the surface of the article to which it will be applied.

The use of a pesticide and/or a herbicide can be advantageous where one wishes to combine the use of the composition of the present invention to insulate an article (*e.g.* food crop) with pesticide and/or herbicide treatment. Such combined treatment will have particular advantages on a commercial scale because it can minimize the labour and costs associated with multiple treatment processes.

Preservatives, for example, may be used in the composition of the present invention in order to minimize the deterioration of the composition in storage and/or transportation, thus ensuring the quality of the composition can be maintained over a long period of time. Suitable preservatives include, but are not limited to, potassium citrate, sodium benzoate or any combination thereof.

Methods Of Manufacture

In another aspect of the present invention, there is provided a method of producing a composition, the method including the steps of:

(a) combining a hydrocolloid (as herein described) with water to form a first mixture;

(b) agitating the first mixture so as to form a second mixture having greater liquid viscosity than the first mixture; and

(c) mixing the second mixture with a cross-linking agent (as herein described) so as to produce a final composition.

In a certain embodiment, there is provided a method of producing a composition, the method including the steps of:

(a) combining CMC and alginate with water to form a first mixture;

(b) agitating the first mixture so as to form a second mixture having greater liquid viscosity than the first mixture; and

(c) mixing the second mixture with potassium sulphate and aluminium potassium sulphate so as to produce a final composition.

In yet another embodiment, gelatin can be combined with CMC, sodium alginate and water to form the first mixture.

In a certain embodiment, the first mixture includes from about from about 0.5% to about 2.0% CMC by weight, from about 0.001% to about 0.02% gelatin by weight and from about 0.01% to about 1.0% sodium alginate by weight of the first mixture.

In yet another embodiment of the present invention, the agitation of step (b) is typically performed for a period of time that is sufficient to increase the liquid viscosity of the second mixture to at least 500 centipoise at ambient temperature. A skilled addressee would be capable of ascertaining the appropriate period of time necessary to achieve this result by means known in the art. For example, in one embodiment, the agitation of step (b) is performed for between about 5 minutes to about 30 minutes.

The composition produced by the methods according to the present invention may include at from about 0.01% to about 2.0% potassium sulphate and at from about 0.01% to about 2.0% aluminium potassium sulphate by weight of the total weight of the composition.

Also encompassed by the present invention is a composition produced by the method according to the present invention, as herein described.

Methods of Application

In another aspect of the present invention, there is provided a method of insulating at least a portion of an article from an effect arising from a change in ambient temperature, the method including applying to a surface of the article the composition according to the present invention, as herein described.

In one embodiment, the composition of the present invention can be used to insulate plants and/or plant foods from an effect arising from a change in ambient temperature, such as frost. Plants and/or plant foods suited to such methods include, but are not limited to, fruit (*e.g.*, apples, pears, apricots, peaches, nectarines, grapes, *etc*), vegetables (*e.g.*, tomatoes, capsicum, cucumber, *etc*) and legumes (*e.g.*, broad beans, snap peas, *etc*). The composition of the present invention may also be used to minimize frost damage to lawn, particularly newly laid turf (on a residential or commercial scale).

The composition of the present invention may also be applied by any means known to the skilled address, including, but not limited to, spraying, dipping and painting. The preferred method of application will typically be determined by the desired result and by the viscosity of the composition. For instance, dipping or spraying may be the preferred method of application for a highly viscous composition, as opposed to spraying. For large-scale, commercial plantations, for example, the application of the composition to food crops may be well suited to spraying, such as by aerial-spraying. The composition may also be applied by the user with hand-held spraying device, such as those used to apply pesticides and the like to crops. The composition need not be applied so as to coat the entire surface of the article to which it is being applied. It may be desirable to apply the composition of the present invention only to a portion of the article if one wishes to insulate only a portion of the article from an effect arising from a change in ambient temperature, such as frost. However, it will be understood by the skilled addressee that any portion of the article that is not covered by the composition of the present invention will be at greater risk of damage arising from external influences such as changes in ambient temperature (*e.g.*, frost).

In yet another embodiment of the present invention, the composition is used to insulate glass from an effect arising from frost. For instance, the composition can be applied to a glass surface of the motor vehicle where insulation against the build-up of ice is desired, such as the windscreen or side windows. It has been found that once the composition has been applied to a surface of the vehicle, any build-up of ice can be peeled away from that surface without the need for further intervention (such as chipping away at the icy layer with a sharp instrument or the application of heated water to that surface).

It has also been found that the composition of the present invention has the inherent characteristics of ordinary water to be able to extinguish a fire, yet also provides a composition that is capable of adhering to the article to which it has been applied.

Thus, the present invention also provides a method of retarding a fire, the method including the step of applying to the fire the composition according to the present invention, as herein described.

With current fire-fighting methodologies, when ordinary water is sprayed onto kindling, for example, the water will only form a very thin film which, given its low adherence, will

result in the water flowing to the ground and therefore losing its impact as a fire retardant. This results in high water usage and low efficiencies, as well as the inability to properly shield and/or extinguish a fire. Typically, the composition of the present invention is applied in a manner sufficient to extinguish the fire at first instance. Methods of application include, but are not limited to, spraying (*e.g.*, as a stream or mist). The composition may also be poured onto the fire, for example, from a container. The amount of composition required to extinguish the fire and the most appropriate method of application would be clear to the user. Without being limited by theory, an advantage of the composition of the present invention is that, as the water component of the fire retarding composition evaporates (*e.g.*, under extreme heat), the cross-linking of the hydrocolloid particles within the residual composition forms an insulating film on the surface of the article to which it has been applied, which has the added effect of isolating an article and shielding it against air and other airborne fire stimulants to ensure that the fire is not reignited or rejuvenated. The composition of the present invention is also relatively non-toxic and is therefore safe for the environment and persons coming into contact with it.

The fire retarding composition need not only be used to retard (*i.e.*, extinguish) a fire. It can also be used to coat an article (*e.g.*, kindling) so as to prevent the article from catching on fire or at least minimize the risk that that article will catch on fire. As indicated earlier, an advantage of the composition of the present invention is that, as the water component of the fire retarding composition evaporates, the residual composition forms an insulating film which has the added effect of isolating an article and shielding it against air and other airborne fire stimulants to ensure that the fire is not reignited or rejuvenated. That is, the resultant layer acts as a shield to protect an article from catching fire. Thus, in another aspect of the present invention, there is provided a method of preventing a fire, the method including the step of applying to an article the composition as herein described.

The fire brigade can thus use the composition of the present invention to shield buildings, trees and flammable liquids from fire. Another advantage of the composition of the present invention is that it can be applied using the hoses currently employed by fire-fighters.

It would be appreciated by one skilled in the art that the methods of retarding a fire or even minimizing the risk that a fire will ignite on an article (such as kindling) using the

composition of the present invention could also be used in any number of combinations with other fire-fighting methodologies currently employed in the art (*e.g.*, with carbon-dioxide or foam extinguishers).

The present invention will now be illustrated in more detail in the following examples. It is to be understood, however, that this example serves only to describe a specific embodiment of the present invention, and should not be taken in any way as a restriction on the generality of the invention as herein described.

The composition of the present invention, as herein described, has also been found by the present inventor to provide for the slow release of water into its surroundings, and therefore lends itself to methods of irrigation.

Throughout history, irrigation has been one of the most important activities in the field of agriculture. Agricultural societies have developed various irrigation systems and equipment therefor. Examples include furrow irrigation, spray irrigation and drip irrigation. By way of overview, irrigation methods typically involve three common factors:

1. A vast irrigation network equipped with complicated apparatus, such as water channels, pumps, valves, filters, etc.
2. The consumption of large amounts of energy, energy being a primary requisite for maintaining an irrigated system; and
3. Most irrigation systems deliver water at ground level resulting in a vast amount of water loss due to evaporation.

In some embodiments, the composition of the present invention is applied to soil for agricultural irrigation and can be done so without the use of expensive or complicated equipment and without consuming substantial amounts of fuel. The composition of the present invention has been found to release a predetermined amount of water to the soil - this irrigation process is carried out by inserting the composition in the ground using what is known as a point irrigation method. Point irrigation is considered a much more efficient method than traditional irrigation methods. As used herein, the term *point irrigation* typically means a method in which moisture is provided by the composition of the present invention, with targeted delivery, to an area around the root system of a plant and hence avoids wasteful diversion of water to other areas of the soil uninhabited by roots of the plants. Accordingly, a smaller amount of water can be used to water the roots of the targeted plants. Point irrigation relies on the fact that

effective delivery of water to roots of the targeted plants involves delivering the water to the root locale and it is immaterial whether the surrounding soil is in dry condition or not.

Thus, in another aspect of the invention, there is provided a method of irrigating ground water using a slow release water delivery composition, wherein the composition includes water, a hydrocolloid and a cross-linking agent, as herein described.

Without being bound by theory, when the composition of the present invention is placed in contact with soil, the contact surface begins to degrade under the action of microbes in the soil. The hydrocolloids are decomposed by the microbes and the composition becomes less viscous, and in the process releases its water.

In some embodiments of the present invention, the composition also includes a means of containing the composition. Examples include a package or container made of a polymer, typically a biodegradable plastic container or flexible shealth. The biodegradable plastic may be made from starch. Alternatively, the package or cover may be substantially non-biodegradable or capable of only slow degradation, such as having half-life of about five years when in contact with soil and made from any one of a range of suitable plastics such as polyethylene. Without being bound by theory, the package or container degrades over time when in contact with the soil and the water from the composition is then slowly released to the soil.

The package or container may be sealed for storage and transport purposes. Immediately prior to use, the package or container may be broken or cut to expose the composition or a portion of the composition to the soil. Without being bound by theory, it is anticipated that, on placing the open package into or onto the soil, the composition will begin to deteriorate at the exposed surface to release water slowly. The greater the breach of, or cut in, the package, the more composition is exposed to the soil and the greater the rate of release of water to the target soil *in situ.* In practice, an operator will prepare the soil immediately adjacent the target, desirably a hole or bore will be formed in the soil next to the root system of a target plant. The desired proportion of the package will be breached to determine the rate of water release and the package containing the composition inserted into the hole or bore. Advantageously, the composition and package may be in the shape of a cylinder so that a standard cylindrical hole-borer may be used to prepare the hole to receive the package containing the composition or the solid composition if in the uncovered form.

The effective period of use or life of one package of the composition will depend on the size or weight of the composition and the size of the breach in the packaging. Where long periods of use are required, the package will contain a large amount of composition and the size of the breach in the package will be minimal to reduce the rate of delivery of water through the breach and to extend the period of use of the composition.

In some embodiments, the package includes a cylindrical starch polymer cover having a substantially hollow cylindrical shape and defining a body of the composition contained therein. A one end of the package can be heat sealed or sealed with a biodegradable adhesive to form a linear strip of joint material. At the opposite end, the walls of the starch polymer cover can be tied together and sealed using a ring seal, tie or other suitable sealing means. In manufacturing, the polymer cover can be oriented upright with its upper end uppermost and the lower end pre-sealed. About 1 litre of water is poured into the polymer cover. A hydrocolloid can then be added to the purified water to adjust the viscosity of the composition, for example, to 500 centipoises or higher. The cross-linking agent can then be added to the glutinous mixture of hydrocolloid and water to form the composition of the present invention.

In some embodiments, the irrigation method of the present irrigation involves varying placement and orientation of the composition depending on the soil type, the climate and the type of plants to be irrigated. Typically, the placement of the composition may be about 20-30 cm deep underground. Such a positioning enables the composition to release water that would typically cover about 20x20cm (400cm^2) of ground area. In compacted soil, the coverage area may be less than for more aerated, loosened or high porosity soil or ground types whether the equivalent composition might provide coverage over a wider area of, for example, 50cmx50cm (2500cm^2) of ground area. This may provide sufficient moisture for smaller agricultural plants such as grape vines, tomato plants and the like. Larger amounts of composition or multiple units of the composition may be used to deliver water to larger plants or larger areas of soil. Because the composition is typically inserted into the ground, the ground level soil may be dry, whereby there is less water loss through evaporation. In this regard, it is observed that water use or demand per unit area is not equal. In areas having thick vegetation, the relative soil holds significantly more water than the equivalent area of a drought stricken or dry soil area. In any case, the insertion of the composition into the

ground is effective to reduce water evaporation in dry and temperate zones through evaporation.

Without being bound by theory, microorganisms present in the soil may assist to promote the degradation the composition of the present invention. Additionally, the composition may be configured to degrade on coming into contact with particular chemicals on pH levels found in soil.

Basic soil cations (Ca, Mg, K) are gradually depleted and replaced with cations held in colloidal soil reserves, leading to soil acidity, after rainfall. Conversely, dry soil will tend to have a higher pH level. Clay soils often contain Fe and hydroxy Al, which affect the retention and availability of fertiliser cations and anions in acidic soils. Soil acidification may also occur by addition of hydrogen, due to decomposition of organic matter, such as the alginate gel, acid-forming fertilizers, and exchange of basic cations for H^+ by the roots. Soil acidity is reduced by volatilisation and denitrification of nitrogen. Under flooded conditions, the soil pH value increases. In addition, the following nitrate fertilizers -- calcium nitrate, magnesium nitrate, potassium nitrate and sodium nitrate -- also increase the soil pH value. Some alkaline soils have Calcium in the form of limestone that is not chemically available to plants. In this case sulfuric acid or Sulfur may be added to reclaim the soil. The particular hydrocolloid selected for the composition of the present invention may adapted to suit a particular soil type.

In some embodiments, the composition of the present invention is directly applied to the soil without the need for a package or container. The composition can be inserted into a bore in the soil. The amount of water released from the composition per unit time will typically depend on the total area of the composition implanted in the soil. The larger the total surface area, the higher rate of water will be released per unit time.

In some embodiments, additives may be included in the composition of the present invention, such as pesticides and/or fertilizers. Typically, the pesticides or fertilizers are soluble in water for direct delivery to the roots of plants and the surrounding soil using the water as a carrier. One or more pesticides and or one or more fertilizers may be included with the composition whereby to be delivered to the roots of the target plants on release of the water from the composition. Accordingly, the pesticides and or fertilizers may be water soluble and trapped within hydrocolloidal structure of the composition to be stored in the solid composition and delivered to the soil proximal to

target roots upon breakdown of the solid gel and to the surrounding soil for effective pesticide treatment.

The water may be initially purified to remove naturally occurring mineral ions such as calcium and magnesium and to remove micro-organisms. This may be achieved by filtration or, more preferably, osmotic equipment. Advantageously, the irrigation methods of the present invention may include the initial step of adding a fertilizer and or a pesticide to the purified water.

The discussion of documents, acts, materials, devices, articles and the like is included in this specification solely for the purpose of providing a context for the present invention. It is not suggested or represented that any or all of these matters formed part of the prior art base or were common general knowledge in the field relevant to the present invention before the priority date of each claim of this application.

Finally it is to be understood that various other modifications and/or alterations may be made without departing from the spirit of the present invention as outlined herein.

EXAMPLES

Example 1:

Method of manufacturing a composition according to one embodiment of the present invention.

Step 1

Add 1% to 1.5% (w/w) of solidifying material to ordinary water and combine in a homogenizer at high speed, so as to dissolve the solidifying material in the water, thus forming a first mixture. The solidify material is a mixture of CMC, gelatin and sodium alginate in weight ratio of 0.95 : 0.0005 : 0.045.

Step 2

The first mixture referred to at Step 1 above is continuously blended in the homogenizer for approximately 10 to 20 minutes or until the viscosity of the solution (the second mixture) has increased to about 800 centipoise at ambient temperature.

Step 3

To the second mixture, add a 7:3 weight ratio of a potassium sulphate and aluminium potassium sulphate mixture, wherein the total weight of the potassium sulphate and aluminium potassium sulphate mixture in the second mixture is approximately 10% by weight of the solidifying mixture referred to at Step 1. Then mix thoroughly until the viscosity of the final composition reaches at least 2000 centipoise at ambient temperature.

Example 2:

A standard small agricultural plant was supplied with irrigated water using 1 kilogram of a package containing the composition according to the present invention. The package was applied using the point method by subterranean insertion into the soil proximal to the roots of the plant. The plant was adequately watered for 90 days.

The same condition of an equivalent plant was achieved over the same 90 day period by delivering 5 litres of water every 10 days over the 90 day period leading to a total water consumption of 500 litres. Accordingly, the equivalent irrigation effect was achieved using a 1 kilogram package of the composition compared to 500 litres of water delivered above ground to an equivalent plant over the same 90 day period.

Example 3:

A pair of substantially identical trees of about 2 metres in height, were the subject of a comparative trial. Tree A received a pair of packages containing the composition of the present invention in week 1. The packages contained 1 kilogram each of the composition and were placed on either side of the Tree A's roots. Each package was inserted down a bore slightly larger than the diameter of each package at a 45^0 angle to a depth of 30cm whereby the lowest most end of each package was located adjacent the peripheral roots of Tree A. The uppermost end of each package was set at a depth of between 5-10cm below the ground level. In each case the bore was covered over and Tree A left to survive or flourish without further input for 12 weeks.

A second tree, Tree B, was watered weekly with 30 litres of water per week delivered by traditional irrigation. The water was delivered by hose from a water tank to a 30 metre long section of agricultural pipe inserted in a corresponding bore in the ground adjacent the base of the tree.

A comparison of Tree A and B showed that there were no material differences in health and growth of the trees. Accordingly, the 2 litres administered by the packages was equivalent in effect to the delivery of 360 litres of water to Tree B using traditional irrigation means. Accordingly, it may be concluded that the traditional irrigation method involved considerable water wastage as well as much higher fuel, labour, tanker maintenance and risk management costs. This was accentuated by the location of the trees on a medium strip in the middle of a major road whereby the use of the tanker, required to repeated start and stop, presented a traffic hazard. The advantage in terms of water saving represented by the use of the inventive packages was a water usage ratio of 1 over 180 or 99.4%.

Through-out the specification and claims the word “comprise” and its derivatives is intended to have an inclusive rather than exclusive meaning unless the context requires otherwise.

It is to be understood that various other modifications and/or alterations may be made without departing from the spirit of the present invention as outlined herein. For instance, the skilled person would know that the scale of the features described herein may be altered without departing from the spirit of the present invention.

The Claims Defining the Invention Are As Follows:

1. A composition including water, a hydrocolloid and a cross-linking agent.

2. The composition according to claim 1, wherein the hydrocolloid is selected from the group consisting of gelatin, starch, carrageenans, guar, locust, tara, Arabic gum, ghatti gum, agar gum, xanthan gum, pectin, gelatin, alginate or an alginic acid derivative, pectin or a pectin derivative, polyvinylpyrrolidone, a carboxyvinyl polymer, a polyethylene oxide polymer, carboxymethyl cellulose, methyl cellulose, hydroxypropyl cellulose, hydroxypropyl methyl cellulose, and any combination thereof.

3. The composition according to claim 2, wherein the hydrocolloid is carboxylmethyl cellulose (CMC).

4. The composition according to claim 3, wherein the composition includes from about 0.5% to about 2.0% w/w of CMC.

5. The composition according to claim 2, wherein the hydrocolloid is alginate or an alginic acid derivative.

6. The composition according to claim 5, wherein the alginate or alginic acid derivative is selected from the group consisting of calcium alginate, polypropylene alginate, potassium alginate, propylene glycol alginate, propylene glycol alginate and sodium alginate, and mixtures thereof.

7. The composition according to claim 6, wherein the alginate is sodium alginate.

8. The composition according to claim 7, wherein the composition includes from about 0.01% to about 1.0% w/w of sodium alginate.

9. The composition according to any one of claims 1 to 8, wherein the cross-linking agent is selected from the group consisting of calcium chloride, magnesium chloride, aluminium chloride, potassium sulphate, aluminium sulphate and aluminium potassium sulphate, and any combination thereof.

10. The composition according to claim 9, wherein the cross-linking agent is potassium sulphate.

11. The composition according to claim 10, wherein the composition includes from about 0.01% to about 2.0% w/w of potassium sulphate.

12. The composition according to claim 8 or 9, wherein the cross-linking agent is aluminium potassium sulphate.

13. The composition according to claim 12, wherein the composition includes from about 0.01% to about 2.0% w/w of aluminium potassium sulphate.

14. The composition according to any one of claims 1 to 13 including gelatin.

15. The composition according to claim 14, wherein the composition includes from about 0.001% to about 0.02% w/w of gelatin.

16. The composition according to claim 1, wherein the composition includes:
(a) from about 0.5% to about 2.0% w/w of CMC;
(b) from about 0.001% to about 0.02% w/w/ of gelatin;
(c) from about 0.01% to about 1.0% w/w of sodium alginate;
(d) from about 0.01% to about 2.0% w/w of potassium sulphate; and
(e) from about 0.01% to about 2.0% w/w of aluminium potassium sulphate.

17. The composition according to claim 16, wherein the composition includes:
(a) from about 0.95% to about 1.5% w/w of CMC;
(b) from about 0.005% to about 0.075% w/w of gelatin;
(c) from about 0.045% to about 0.0675% w/w of sodium alginate;
(d) from about 0.07% to about 0.2% w/w of potassium sulphate; and
(e) from about 0.03% to about 0.07% w/w of aluminium potassium sulphate.

18. The composition according to any one of claims 1 to 17, wherein the composition has a viscosity of at least 500 centipoise at ambient temperature.

19. The composition according to claim 18, wherein the composition has a viscosity of at least 2000 centipoise at ambient temperature.

20. A method of producing a composition, the method including the steps of:

(a) combining a hydrocolloid with water to provide a first mixture;
(b) agitating the first mixture so as to form a second mixture having greater liquid viscosity than the first mixture; and
(c) mixing the second mixture with a cross-linking agent so as to produce a final composition.

21. A method of producing a composition, the method including the steps of:

(a) combining CMC and alginate with water to provide a first mixture;
(b) agitating the first mixture so as to form a second mixture having greater liquid viscosity than the first mixture; and
(c) mixing the second mixture with potassium sulphate and aluminium potassium sulphate so as to produce a final composition.

22. The method according to claim 21 including combining gelatin with CMC, sodium alginate and water in the first mixture.

23. The method according to claim 22, wherein the first mixture includes from about 0.5% to about 2.0% w/w of CMC, from about 0.001% to about 0.02% w/w of gelatin and from about 0.01% to about 1.0% w/w of sodium alginate.

24. The method according to any one of claims 20 to 23, wherein in step (b), the first mixture is agitated for a period of time sufficient to increase the viscosity of the second mixture to at least 500 centipoise at ambient temperature.

25. The method according to any one of claims 20 to 24, wherein the composition includes from about 0.01% to about 2.0% w/w of potassium sulphate and from about 0.01% to about 2.0% w/w of aluminium potassium sulphate.

26. The method according to any one of claims 20 to 25, wherein the composition has a viscosity of at least 500 centipoise at ambient temperature.

27. The method according to any one of claims 20 to 25, wherein the composition has a viscosity of at least 2000 centipoise at ambient temperature.

28. A composition produced by a method according to any one of claims 20 to 27.

29. A method of retarding a fire, the method including the step of applying to the fire the composition according to any one of claims 1 to 19 and 28.

30. A method of preventing a fire on an article, the method including the step of applying to the article the composition according to any one of claims 1 to 19 and 28.

31. A method of insulating at least a portion of an article from an effect arising from a change in ambient temperature, the method including applying to a surface of the article the composition according to any one of claims 1 to 19 and 28.

32. A method according to claim 31, wherein the article is glass.

33. A method according to claim 31, wherein the article is a plant or plant food.

34. The composition according to any one of claims 1 to 19 and 28, including a dye, a pesticide, a herbicide, a preservative, or any combination thereof.

35. The composition according to claim 31, wherein said preservative is potassium citrate and/or sodium benzoate.

36. A method of irrigating an area of soil or suitable agricultural medium, the method including contacting the soil or agricultural medium with the composition according to any one of claims 1 to 19 and 28.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU2008/001102

A. CLASSIFICATION OF SUBJECT MATTER

Int. Cl. ***C08L 1/02*** (2006.01) ***C08K 3/24*** (2006.01) ***C08L 5/06*** (2006.01) ***C08K 3/00*** (2006.01) ***C08L 3/00*** (2006.01) ***C08L 39/06*** (2006.01) ***C08K 3/16*** (2006.01) ***C08L 5/04*** (2006.01)

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)

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

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
WPI; EPODOC; TXTEN; CAPLUS; JAPIO & Esp@cenet: hydrocolloid; OR gum, alginate, cellulose, carboxymethyl w cellulose, cmc, starch, xanthan, pectin, pvp, polyvinylpyrrolidone, gelatin; cross_link+ and like terms.

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 6719797 B1 (FERREE) 13 April 2004 Abstract; col. 3, lines 7-23; claims 1-2, 5, 9	1-4, 8-15
X	US 2006/0063140 A1 (NUSSINOVITCH et al.) 23 March 2006 Abstract; paragraph [0021]; claims 1-2, 19-20, 31-33; paragraph [0030], paragraph [0100]	1-2, 5-7
X	EP 0808580 A2 (HECULES INCORPORATED) 16 June 1999 Abstract; Claim 1	1

[X] Further documents are listed in the continuation of Box C [X] 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

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"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

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"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	Date of mailing of the international search report
14 August 2008	20 AUG 2008
Name and mailing address of the ISA/AU AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA E-mail address: pct@ipaustralia.gov.au Facsimile No. +61 2 6283 7999	Authorized officer **DEBASHIS ROY** AUSTRALIAN PATENT OFFICE (ISO 9001 Quality Certified Service) Telephone No : (02) 6225 6125

INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU2008/001102

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2003/0124195 A1 (DELPRATO et al.) 3 July 2003 claim 1; paragraph [0079]; claim 13; claims 34-35	1-2, 31-36
A	US 5690869 A (HINTERWALDNER et al.) 25 November 1997 Abstract; col. 6, lines 57-67	1-3, 5, 29-30

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/AU2008/001102

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report		Patent Family Member					
US	6719797	AU	50475/00	AU	63465/01	AU	2003228655
		AU	2003229001	AU	2003239172	CA	2375691
		CA	2377836	CA	2483226	CA	2483266
		EP	1180978	EP	1292251	EP	1496818
		EP	1503682	US	6245107	US	6340369
		US	6344058	US	6352557	US	6371990
		US	6419702	US	6419704	US	6432107
		US	6454804	US	6491724	US	6494883
		US	6645247	US	6648918	US	6648919
		US	6648920	US	6685695	US	6706068
		US	6743255	US	6755863	US	6793677
		US	6875235	US	6878167	US	6969404
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		US	7201774	US	7201776	US	7235102
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		US	2003026788	US	2003040796	US	2003074076
		US	2003078579	US	2003191536	US	2003195630
		US	2003199981	US	2003204271	US	2003233097
		US	2003233148	US	2004010318	US	2004024459
		US	2004024460	US	2004024461	US	2004024462
		US	2004030390	US	2004030391	US	2004030398
		US	2004044410	US	2004073311	US	2004093092
		US	2004097980	US	2004111155	US	2004122424
		US	2004172019	US	2004186573	US	2004230310
		US	2004236342	US	2004249461	US	2004260286
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		WO	0110316	WO	0189429	WO	03090603
		WO	03090649	WO	03094806	WO	2005006944
		WO	2006012590				
US	2006063140	AU	62267/99	WO	0022105		
EP	0808580	AU	23552/97	CA	2205517	JP	10042803
		MX	9703697				
US	2003124195	AU	60408/01	BR	0110880	CN	1432025
		EP	1285005	FR	2808705	WO	0187987
US	5690869	CA	2162280	DE	4419724	EP	0730493
		WO	9533554				

Due to data integration issues this family listing may not include 10 digit Australian applications filed since May 2001.

END OF ANNEX