DOCUMENT D1 (state of the art):

Biodegradable superabsorbent polymer and soil-improving composition containing the polymer

[001] In arid climates, agricultural yields are often limited by the inability of the soil to store water. Thus even where irrigation water is available, it is used inefficiently. It has been proposed to add a superabsorbent polymer to the soil to improve its water-retaining capacity. A significant problem with this proposal is that the superabsorbent polymers available on the market are polyacrylics and thus only biodegrade very slowly. It is not permitted to include non-biodegradable materials in soil-improving compositions in many countries.

[002] In order to solve this problem, a new superabsorbent polymer is proposed which is a cross-linked mixture of sodium carboxymethylcellulose (CMCNa) and hydroxyethylcellulose (HEC). The weight ratio between CMCNa and HEC may be from 0.1 to 5.0 and is preferably from 0.8 to 1.6. This weight ratio ensures that the polymer is able to absorb a large quantity of water and release it to plants. The cross-linking is performed in aqueous solution and any known cross-linking agent such as epichlorohydrin, formaldehyde, carbodiimides and divinylsulphone may be used. The gel obtained in this step is washed with deionised water and dried by phase inversion. The polymer is obtained as white granules.

[003] The granules of superabsorbent polymer can be applied to soil by conventional means such as by spreading or dispersing in a liquid carrier and spraying. However, in one preferred embodiment the granules are placed in a bag made from biodegradable cellulosic fibres. The bag may also contain fertilizer or pesticides mixed with the superabsorbent granules. The bag must obviously allow water to pass through it unhindered. This embodiment is very useful as it ensures that the superabsorbent polymer can be accurately located to provide water only to the roots of the plant.

Example 1:

[004] An aqueous solution of CMCNa and HEC was prepared. The overall concentration of CMCNa and HEC was 5 wt.%. 1-Ethyl-3-(3-dimethylaminopropyl)carbodiimide (EDC) as cross-linking agent was added until its concentration in the aqueous solution was 7 wt.%. Citric acid was then added as an acid catalyst giving rise to a solution of pH 4.0. The gel obtained was washed with deionised water and dried by phase inversion in acetone. The absorption capacity was measured in accordance with the method described in US-A-3 000 000. The water release capacity was measured by absorbing 20 g of deionised water into 1 g of the polymer and then drying it in a flow of dry air at 30°C for 3 hours. The percentage water remaining in the polymer is then measured. Values of from 38 to 50% are ideal for superabsorbent polymer for conditioning soil.

[005] The results are presented in Table 1:

CMCNa to HEC weight ratio	Absorption capacity g H_2O per g polymer	Water release capacity (%)
0.8	36	40
1.0	34	42
1.2	39	43
1.4	36	45
1.6	38	51

Example 2:

[006] Granules with a weight ratio of CMCNa to HEC of 1.2 manufactured in accordance with example 1 were used in a practical test in a field used to grow lettuce in southern Spain. The granules were spread on one half of the field and the other half was left untreated.

[007] Lettuces were planted in the field and irrigated according to the standard procedure. Once the plants were established, each half of the field was only watered upon the first sign of wilting. The half of the field treated with the granules required 30% less water. The quality of the lettuces grown on each half of the field was identical.

[008] In order to test for biodegradability, a sample of soil from the field was investigated one year after the initial treatment with the polymer. No traces of the polymer could be detected, demonstrating that the polymer was completely biodegraded.

Claims

1. Superabsorbent polymer consisting of a cross-linked mixture of sodium carboxymethylcellulose (CMCNa) and hydroxyethylcellulose (HEC).

2. Superabsorbent polymer according to claim 1 where the weight ratio of CMCNa to HEC is from 0.8 to 1.6

3. The use of the superabsorbent polymer of claims 1 or 2 as a soil conditioner.