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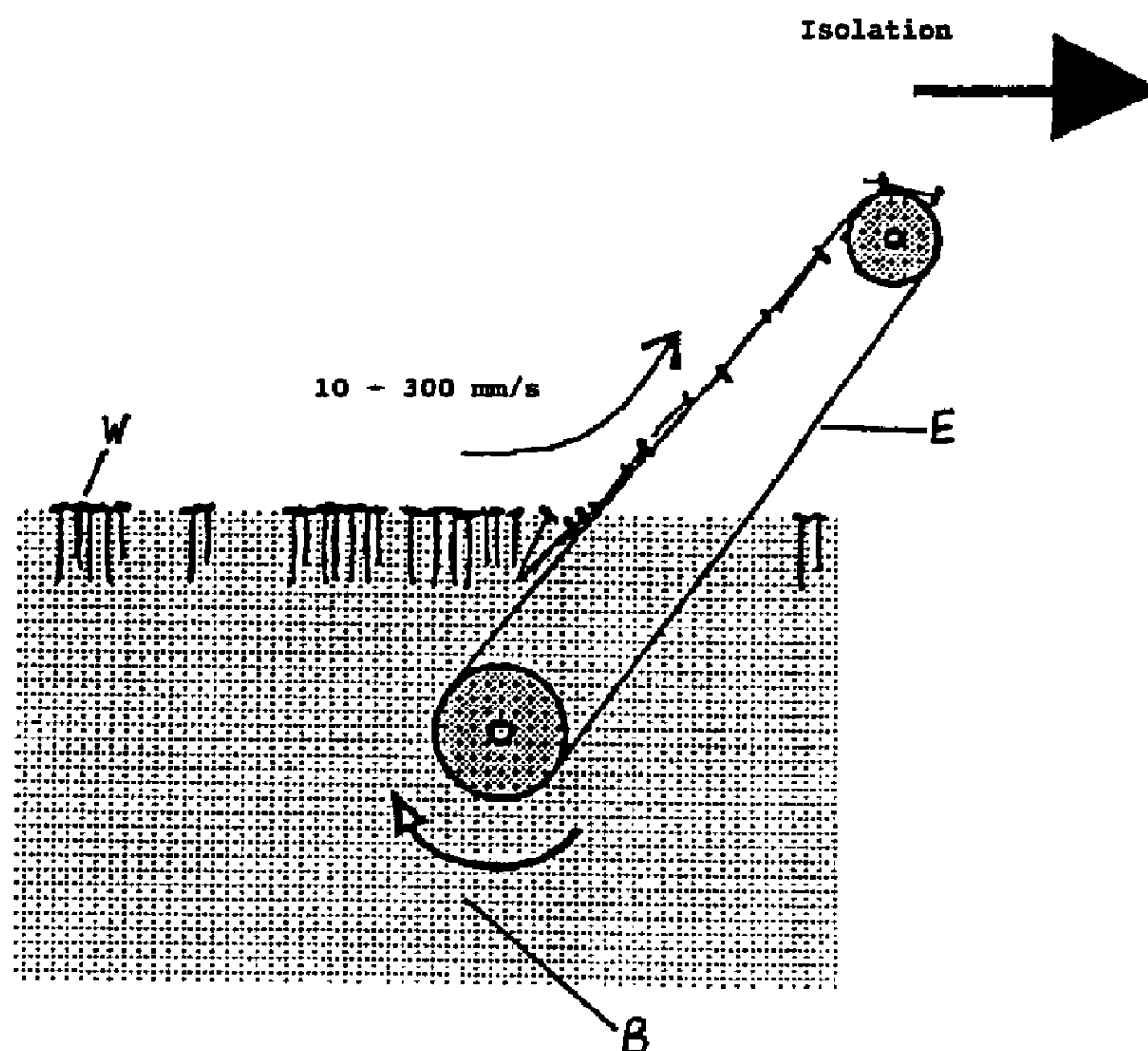
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(54) Titre : METHODE POUR CUEILLIR EN DOUCEUR DES PLANTES AQUATIQUES FLOTTANT A LA SURFACE DE L'EAU

(54) Title: METHOD FOR THE GENTLE ISOLATION OF AQUATIC PLANTS WHICH FLOAT ON THE WATER



(57) Abrégé/Abstract:

The invention relates to a method for the gentle isolation from ponds, basins or containers of aquatic plants which float on the water. The process according to the invention comprises a) generating, on the water surface in the pond, basin or container, a flow which is directed toward the site of withdrawal, which drives the aquatic plants toward the site of withdrawal, b) withdrawing the aquatic plants individually at the site of withdrawal from the pond, basin or container by means of a hydrophilic solid or liquid medium, and c) transferring the aquatic plants individually into containers.

Abstract

The invention relates to a method for the gentle isolation from ponds, basins or containers of aquatic plants which float on the water. The process according to the invention comprises

- a) generating, on the water surface in the pond, basin or container, a flow which is directed toward the site of withdrawal, which drives the aquatic plants toward the site of withdrawal,
- b) withdrawing the aquatic plants individually at the site of withdrawal from the pond, basin or container by means of a hydrophilic solid or liquid medium, and
- c) transferring the aquatic plants individually into containers.

Method for the gentle isolation of aquatic plants which float on the water

- 5 The invention relates to a method for the gentle isolation from ponds, basins or containers of aquatic plants which float on the water.
- 10 Aquatic plants which float on the water (free-floating plants), for example Lemna species, Azolla species and Salvinia species, float on the water surface with their leaves while their roots, which, depending on the species, have different shapes, protrude into the water. In ponds, storage basins or nursery basins, these
- 15 plants may form dense layers made up of many thousand individuals. Free-floating plants are very important as test systems for investigations in the fields of crop protection and plant genetics since a large number of them can be grown in confined spaces, since they live in a medium whose composition is
- 20 easy to control and to manipulate (water) and since, in addition, their symbiosis with species of Cyanobacteria such as Nostoc and Anabaena, for example in the leaflets of Azolla species, they have developed a method of storing nitrogen which, if possible, should be made exploitable for genetic engineering purposes.
- 25 For experimental purposes it is necessary to transfer the individual plants into test containers, which has been carried out manually until now and entails substantial personnel and thus also financial input.
- 30 DE-A-44 25 522 discloses the separation of free-flowing bulk materials, for example wheat, with the aid of a belt-type cell selector, thus achieving higher throughput in comparison with cylindrical sorting and cleaning devices.
- 35 GB-B-2 184 033 discloses an apparatus which allows an improved mechanization when examining small test volumes by liquid chromatography by means of a shaped conveyor belt.
- 40 The conveyor belts used are neither hydrophilic nor is mention made of their use for the isolation of free-floating plants.
- 45 It is an object of the present invention to mechanize and/or automatize the isolation, and separation into individual units, of free-floating aquatic plants.

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Surprisingly, it has been found that aquatic plants adhere more strongly to wet surfaces than to each other. Surprisingly, it has also been found that aquatic plants can be separated from each other by suction or by water jets of a specific power.

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The present invention therefore relates to a method for the gentle isolation from ponds, basins or containers of aquatic plants which float on the water, which comprises

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a) generating, on the water surface in the pond, basin or container, a flow which is directed toward the site of withdrawal, which drives the aquatic plants toward the site of withdrawal,

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b) withdrawing the aquatic plants individually at the site of withdrawal from the pond, basin or container by means of a hydrophilic solid or liquid medium, and

c) transferring the aquatic plants individually into containers.

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In a preferred embodiment of the process according to the invention, the directed flow described in a) is generated by immersing one or more hydrophilic solids into the water and moving it or them out of the water toward the site of withdrawal at a speed at which the surface of the water film which wets the

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hydrophilic solid is retained as long as possible.

Hydrophilic solids for the purposes of the present invention are those solids which are wettable by water.

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Hydrophilic solids which are especially suitable in accordance with the invention are, for example, threads, tapes, rods or poles, in particular endless loops or rotating disks made of thoroughly wettable materials, in particular endless loops made from hydrophilic or surface-hydrophilized elastomers. Hydrophilic or surface-hydrophilized elastomers which can be used in accordance with the invention are, for example,

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ethylene/propylene rubber (EPR) modified by irradiation-induced grafting of acrylic acid (known from Soebianto, Y.S. et al.,

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Angew. Makromol. Chem. (1987) 152, p. 149 - 158), hydrophilic polyvinyl siloxanes (known from Bader, F. and Setz, J., Dent.

Lab. (1992) 40/3, p. 421 - 423), polyethylene or polymethyl methacrylate which has been surface-treated by oxidation with chromic acid solutions or by hot-pressing between Teflon® slabs

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(known from Wang, R.-H. and Stoffer, J.O., Polym. Mater. Sci.

Eng. (1992) 67, p. 123 - 124), polyethylene which has been

surface-modified by treatment with nitrogen oxide plasma (known

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from Inagaki, N. et al., Appl. Polym. Symp. (1990) 46, p. 399 - 413), hydrophilic polyurethane/urea elastomers with ethylene oxide and tetramethylene oxide groups (known from Dror, M. and Stewart, M., Annu. Tech. Conf. Soc. Plast. Eng. (1990), p. 1132 - 1134), hydrophilic polyether elastomers (known from Shih, J.S. and Tirrell, D.A., J. Polym. Sci., Polym. Chem. Ed. (1984) 22/3, p. 781 - 791), polypropylene which has been hydrophilized by means of plasma graft polymerization of glycidyl methacrylate (known from Inagaki, N. et al., Polym. Bull. (1991) 26/3, p. 283 - 289) and polyethylenes which have been surface-modified by introducing amide or ester groups (known from Wilson, M.D. et al., J. Am. Chem. Soc. (1990) 112/3, p. 1244 - 1245). Other processes for the preparation of hydrophilic or surface-hydrophilized elastomers which are suitable in accordance with the invention are known from Kreiner, C.F., Technical Lecture WVAO Annual Conference (1985), p. 148 - 156.

If such a hydrophilic solid is pulled out of the water, a film of water forms on its surface. This process simultaneously generates a flow on the water surface toward the hydrophilic solid. This flow causes objects which float on the water surface, for example free-floating plants, to move toward the hydrophilic solid. The result is that the free-floating plants eventually come into contact with the hydrophilic solid and, due to adhesion, adhere to the hydrophilic solid together with the film of water when the hydrophilic solid is pulled out of the water. A condition is that the speed with which the solid is immersed into the water and pulled out of the water allows the film of water located on the solid to remain stable as long as possible. This is why it is advantageous to move the solids only slowly, preferably at a speed of 0.5 to 500, in particular 5 to 300 mm/s, especially preferably 10 to 50 mm/s.

The use of rotating disks and, in particular, endless loops made from hydrophilic elastomer is especially preferred since the free-floating plants can be withdrawn from the water continuously if the arrangement and speed are suitable. Such an endless loop is shown, for example, in Figure 1, where W denotes aquatic plants, B a basin and E an endless loop.

A further preferred embodiment of the process according to the invention consists in generating the directed flow described in a) in such a way that water jets are expelled toward the site of withdrawal from one or more nozzles arranged beneath the water surface. The diameter of the nozzles, and the pressure of the water jets produced by them, can be varied within a wide range to

suit the shape, size and mass of the plants to be separated into individual units. Typically, the nozzle diameter is approximately 0.05 to 5 mm, in particular approximately 0.1 to 2 mm. The outlet pressure of the water jet flowing from the nozzle is, as a rule,
5 at approximately 0.5 to 5 bar, in particular approximately 2 to 3 bar.

The nozzles used for generating the flow can expediently also be used for the separation of the aquatic plants into individual
10 units, as described in b). Ideally, the nozzles, which are arranged beneath the water surface at the site of withdrawal and which remove the aquatic plants from the water individually, are fixed at an angle of approximately 45° relative to the water surface. Nozzle diameter and water pressure should be as
15 described above. The water level should be kept constant, for example by means of a control circuit.

A further preferred embodiment of the process according to the invention consists in generating the directed flow described in
20 a) by placing a suction device at the site of withdrawal beneath the water surface and drawing water toward the site of withdrawal. The plants which float on the water surface thus drift toward the site of withdrawal. The aquatic plants can then expediently be drawn out of the water individually at the site of
25 withdrawal by means of the suction device placed beneath the water surface. In principle, this may also be effected parallel to the water surface or directly on the water surface. However, when the plants are removed from the water surface, the air which is also drawn in interferes with the detection of the plants for
30 the subsequent and necessary separation step. Drawing-off can be effected with customary pumps, for example with electrically operated suction pumps. A prerequisite for this procedure is an exact control of the water level and of the drawing-off rate.

35 In principle, each of the methodological steps according to the invention for generating the flow can be combined with each methodological step in accordance with the invention for withdrawing the aquatic plants. However, it is generally
40 preferable to carry out the withdrawal with the same devices with which the flow had been generated, since the equipment is less complicated.

After detection, for example by means of a light barrier
45 (capacitive or inductive method) and subsequent transfer into individual containers by means of an air or water jet, the the

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aquatic plants which have been withdrawn in accordance with the invention can now be isolated.

5 The examples which follow illustrate the invention without limiting it thereto:

Example 1

10 Approximately 100 Lemna plants are grown in a 5-l glass container containing 4 l of water. An elastomer tape according to the invention of 2 mm width is drawn through the water at a speed of 10 - 50 mm/sec by means of an electric motor. The plants are thus withdrawn from the water individually on the elastomer tape and can be flushed individually into containers using a water jet.

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Example 2

20 Approximately 100 Lemna plants are grown in a 5-l glass container containing 4 l of water. Approximately 3 mm beneath the water surface, a hollow needle with an outlet opening 0.2 mm in diameter is fixed so that it points upwards at an angle of approximately 45°, and a water line with a pressure of approximately 3 bar is connected to the hollow needle. The Lemna plants move toward the water outlet and are transported individually out of the glass container together with the water
25 jet.

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We claim:

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1. A method for the gentle isolation from ponds, basins or containers of aquatic plants which float on the water, which comprises

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a) generating, on the water surface in the pond, basin or container, a flow which is directed toward the site of withdrawal, which drives the aquatic plants toward the site of withdrawal,

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b) withdrawing the aquatic plants individually at the site of withdrawal from the pond, basin or container by means of a hydrophilic solid or liquid medium, and

c) transferring the aquatic plants individually into containers.

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2. A method as claimed in claim 1, wherein the directed flow is generated by immersing one or more hydrophilic solids into the water and moving it or them out of the water toward the site of withdrawal at a speed at which the surface of the water film which wets the hydrophilic solid is retained as long as possible.

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3. A method as claimed in claim 1 or 2, wherein the hydrophilic solids are threads, tapes, rods poles, endless loops or rotating disks.

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4. A method as claimed in claim 3, wherein the hydrophilic solid used is an endless loop made from hydrophilic or surface-hydrophilized elastomer.

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5. A method as claimed in claim 4, wherein the hydrophilic or surface-hydrophilized elastomer is selected from the group consisting of ethylene/propylene rubber which has been modified by irradiation-induced grafting of acrylic acid, hydrophilic polyvinyl siloxane, polyethylene or polymethyl methacrylate which has been surface-modified by oxidation with chromic acid solution or by hot-pressing between Teflon® slabs, polyethylene which has been surface-modified with nitrogen oxide plasma, hydrophilic polyurethane/urea elastomer with ethylene oxide and tetramethylene oxide groups, hydrophilic polyether elastomer, or polypropylene

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which has been hydrophilized by plasma graft polymerization of glycidyl methacrylate.

6. A method as claimed in claim 1, wherein the directed flow is generated by expelling water jets toward the site of withdrawal from one or more nozzles arranged beneath the water surface.

7. A method as claimed in claim 1, wherein the directed flow is generated by placing a suction device at the site of withdrawal beneath the water surface and drawing water
10 toward the site of withdrawal.

8. A method as claimed in any one of claims 1 to 7, wherein the aquatic plants are withdrawn from the ponds, basins or containers at the site of withdrawal by means of hydrophilic solids, by immersing the solids into the water and removing them from the water at a speed at which the plants adhere to the solids individually.

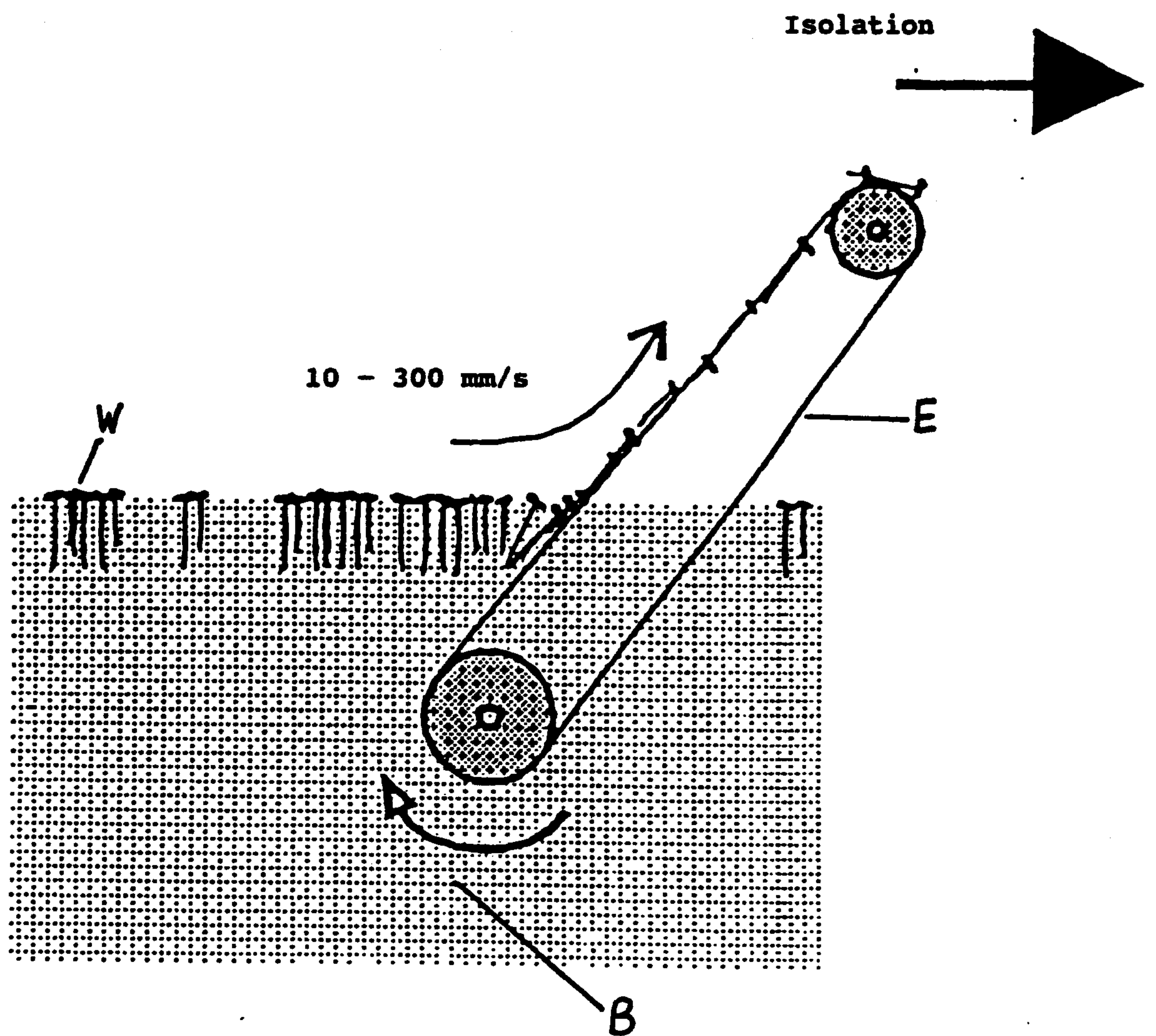
9. A method as claimed in any one of claims 1 to 7, wherein the aquatic plants are transferred individually from the ponds, basins or containers at the site of
20 withdrawal by means of a water jet expelled from a nozzle which is arranged beneath the water surface.

10. A method as claimed in any one of claims 1 to 7, wherein the aquatic plants are drawn individually from the ponds, basins or containers by means of a suction device which is placed beneath the water surface.

11. A method as claimed in claim 1, wherein, after detection by means of a light barrier and subsequent

transfer into individual containers by means of an air or water jet, the aquatic plants which have been withdrawn are isolated.

Figure 1



Isolation

