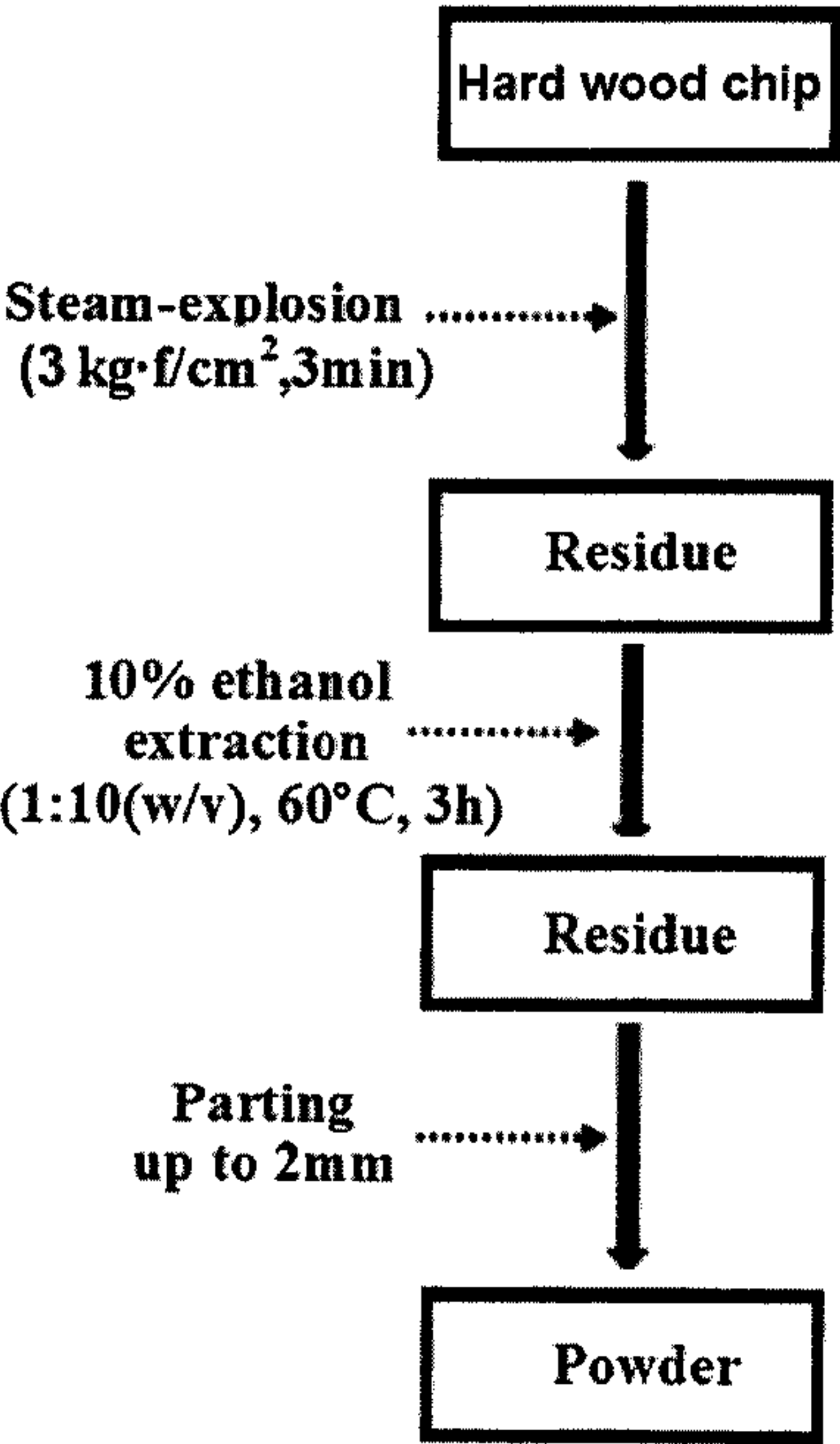




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(54) Titre : MATIERE A BASE DE VEGETATION SERVANT A RETABLIR LA ZONE D'EXPLOITATION DE CARRIERES
ET METHODE DE PREPARATION ASSOCIEE
(54) Title: VEGETATION-BASED MATERIAL FOR RESTORING QUARRY MINES DEVELOPMENT AREA AND
METHOD OF PREPARING THE SAME



(57) **Abrégé/Abstract:**
The present invention relates to a vegetation-based material for restoration of quarry mines development area, bedrock area and a method of preparing the same, more particularly to a vegetation-based material for restoration of quarry mines development area

(57) **Abrégé(suite)/Abstract(continued):**

and bedrock area comprising peat moss, perlite, steam exploded wood chip, defiberized pulp, soil stabilizer and water in a weight ratio of (1.0 - 5.0) : (0.1 - 3.0) : (1.0 - 5.0) : (0.1 - 3.0) : (0.1 - 3.0) : (1.0 - 5.0)(w/w/w/w/w/w). When the vegetation-based material according to the present invention is applied to a special place having a slope in the quarry mines development area and bedrock area, it is possible to promote the early graft-take and expedited growth of the plant and stabilize the slope due to the effect of mitigating the soil outflow for smooth vegetation.

ABSTRACT

The present invention relates to a vegetation-based material for restoration of quarry mines development area, bedrock area and a method of preparing the same, more particularly to a vegetation-based material for
5 restoration of quarry mines development area and bedrock area comprising peat moss, perlite, steam exploded wood chip, defiberized pulp, soil stabilizer and water in a weight ratio of (1.0 - 5.0) : (0.1 - 3.0) : (1.0 - 5.0) : (0.1 - 3.0) : (0.1 - 3.0) : (1.0 - 5.0)(w/w/w/w/w/w).

When the vegetation-based material according to the present invention
10 is applied to a special place having a slope in the quarry mines development area and bedrock area, it is possible to promote the early graft-take and expedited growth of the plant and stabilize the slope due to the effect of mitigating the soil outflow for smooth vegetation.

VEGETATION-BASED MATERIAL FOR RESTORING QUARRY MINES

DEVELOPMENT AREA AND METHOD OF PREPARING THE SAME

CROSS-REFERENCE TO RELATED APPLICATION

5 This application claims priority to and the benefit of Korean Patent Application No. 10-2017-0181203 filed in the Korean Intellectual Property Office on December 27, 2017, the entire contents of which are incorporated herein by reference.

10 BACKGROUND OF THE DISCLOSURE

1. Field of the Disclosure

 The present invention relates to a vegetation-based material and a method of preparing the same for early graft-take and expedited growth of the plant, which is required for covering soil of waste rock site, quarry rock face and
15 bedrock face of slope.

2. Description of the Related Art

 Erosion in slopes of quarry mines and bedrock areas is accelerated by exposure of soil due to the construction of roads or the degradation of vegetation, and it causes a lot of problems by a lot of soil outflow.

20 In addition, aggregate or stone production is practically increasing and most of these are collected in forests, which can cause environmental damages by exposing face of slope in bedrock in the quarry mines development area.

 Artificial facilities are used to prevent the outflow and erosion of the soil, but it is a trend to avoid because it is not in harmony with the surrounding

environment and the effect of restoration of beautiful scenery is minimal. Accordingly, attempts have been made to prevent the loss of soil by sowing, planting and afforestation using vegetation-based materials.

In particular, slope erosion can be relatively simply prevented by sowing
5 plant using vegetation-based materials on slopes.

The environmental disadvantages of slopes in quarry mines and bedrock areas induce physical characteristics that make it difficult to settle and grow plants. In particular, many plants that have been sowed or planted by rainfall are lost, and it is most important to take root of the plant within a short
10 time after sowing of the plant.

Therefore, in order to recover the beautiful scenery of the bedrock before it is damaged, vegetation-based materials are necessary for restoration and greening.

[Documents of prior arts]

15 [Patent documents]

Korean Patent Publication No. 0748602 (published on August 6, 2007)

SUMMARY OF THE DISCLOSURE

It is an object of the present invention to provide a vegetation-based
20 material for restoring quarry mines development area, bedrock area and a method of preparing the same, which can provide an environment of capable of plant growing in an extreme environment in which plants cannot grow and is strong against rainfall or soil erosion and can achieve plant covering early.

In order to achieve the above object, the present invention provides a vegetation-based material for restoring quarry mines development area and bedrock area, comprising peat moss, perlite, steam exploded wood chip, defiberized pulp, soil stabilizer and water in weight ratio of (1.0 - 5.0) : (0.1 - 3.0) : (1.0 - 5.0) : (0.1 - 3.0) : (0.1 - 3.0) : (1.0 - 5.0)(w/w/w/w/w/w).

Also, the present invention provides a method of preparing a vegetation-based material for restoring quarry mines development area and bedrock area comprising: preparing a mixture by mixing peat moss, perlite, steam exploded wood chip, defiberized pulp and soil stabilizer; and producing a vegetation-based material for restoring quarry mines development area and bedrock area by adding water to the mixture and mixing the same.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic view showing a process for preparing ethanol-extracted residue of a steam exploded oak wood;

FIG. 2 shows a soil outflow test apparatus;

FIG. 3 shows the results of evaluation of the soil outflow ratio of the vegetation-based material according to mixing the soil stabilizer;

FIG. 4 shows the results of image of the soil outflow of the vegetation-based material according to mixing the soil stabilizer;

FIG. 5 illustrates ways of applying vegetation-based material;

FIG. 6 shows a process of preparing test land according to the mixing ratio of the soil and the vegetation-based material according to the granite type;

FIG. 7 shows a state after completion of test land according to the mixing ratio of the soil and the vegetation-based material according to the

granite type;

FIG. 8 is a graph showing the hardness of soils and vegetation-based materials;

5 FIG. 9 is a graph showing the temperatures of soil and vegetation based material;

FIG. 10 is a graph showing the moisture of soil and vegetation-based material;

FIG. 11 is a graph showing the plant cover rate of the vegetation-based material according to granite type;

10 FIG. 12 shows application process of vegetation-based material at the site of quarry mines development area;

FIG. 13 is a graph showing the salinity of a vegetation-based material for restoring quarry mines development area;

15 FIG. 14 is a graph view showing the organic matter content of a vegetation-based material for restoring quarry mines development area; and

FIG. 15 is a view showing the plant cover rate of a vegetation-based material for restoring quarry mines development area.

DETAILED DESCRIPTION OF THE EMBODIMENTS

20 Hereinafter, a vegetation-based material for restoring quarry mines development area, bedrock area and a method of preparing the same will be described in more detail.

During researching and developing a vegetation-based material for restoring quarry mines development area and bedrock area, the inventors of the present invention has found that when a soil stabilizer is added to the

vegetation-based material, the greening of the quarry mines development area and bedrock area can be accelerated and it is effective for mitigation of soil outflow for smooth vegetation in a special place having a slope in the quarry mines development area, bedrock area and can be used for restoring the quarry mines development area, bedrock area and has accomplished the present invention.

The present invention provides a vegetation-based material for restoring quarry mines development area and bedrock area, comprising peat moss, perlite, steam exploded wood chip, defiberized pulp, soil stabilizer and water in weight ratio of (1.0 - 5.0) : (0.1 - 3.0) : (1.0 - 5.0) : (0.1 - 3.0) : (0.1 - 3.0) : (1.0 - 5.0) (w/w/w/w/w/w).

The peat moss has a capacity for holding large amount of water and can be used as a water source for seeds, and when mixed with soil, the peat moss increases the air permeability of the soil thereby helping root growth. In addition, the addition of peat moss to the soil can prevent the components affecting the vegetation from being leached, and can prevent sticking of the soil and hindering the growth of the root.

If the peat moss is contained in an amount exceeding the above range, there is a possibility of causing a problem of leaching or loss due to rain or wind.

The perlite included in the vegetation-based material as a porous material, provides pores to have breathability of the vegetation-based material. If the perlite is contained in a range exceeding the above range, there is a problem that it is difficult to adhere the vegetation-based material for restoring the quarry mines development area in a special place having a slope in the

quarry mines development area.

The vegetation-based material for restoring quarry mines development area and bedrock area comprises peat moss, perlite, steam exploded wood chip, defiberized pulp, soil stabilizer and water in weight ratio of 3 : 1 : 3 : 0.1 : 0.5 : 2.4 (w/w/w/w/w/w), but it is not limited thereto.

When the content of peat moss, perlite, steam exploded wood chip, defiberized pulp dissolution liquid and soil stabilizer for restoring quarry mines development area and bedrock area does not fall within the above range, the hardness, temperature, moisture, salinity and organic matter of the vegetation-based material do not have the optimum range advantageous for plant growth.

The steam exploded wood chip may be a residue produced by mixing at least one wood selected from the group consisting of oak, Sawtooth oak, Oriental white oak, Konara oak, Mongolian oak, Chinese cork oak and Daimyo oak in a form of a chip which is steam-exploded for 1 to 10 minutes with a steam of 1 to 10 kgf/cm² in ethanol in a ratio of 1 : (5-15) (w/w) and extracting with ethanol at 50 to 70 °C for 2 to 4 hours, but it is not limited thereto.

In the case of steam explosion, available oil can be extracted from the steam exploded wood chip, and the available oil can supply carbohydrates, minerals, inorganic components and phenolic compounds necessary for the vegetation.

If the steam explosion is performed out of the above conditions, the fiber of the steam exploded wood chip is not torn, pulverized and discoloration thereof does not occur and the active ingredient required for the vegetation-based material for restoring quarry mines development area and bedrock area

cannot be extracted.

When wood in the form of the steam-exploded chip is extracted with ethanol, there is an advantage that the phenolic compound inhibiting plant growth is removed.

5 When the hot water extraction is carried out beyond the above conditions, there are problems that the phenolic compounds showing the inhibition of the plant growth are not sufficiently removed or it is adverse to the growth of green plants, e.g. the carbohydrate, which is a nutrient of green plants, flows out.

10 The soil stabilizer may be any one selected from the group consisting of carboxymethyl cellulose (CMC), carboxymethyl starch (CMS), and guar gum, but it is not limited thereto.

 In addition, the present invention provides a method of preparing a vegetation-based material for restoring quarry mines development area and
15 bedrock area comprising: preparing a mixture by mixing peat moss, perlite, steam exploded wood chip, defiberized pulp and soil stabilizer; and producing a vegetation-based material for restoring quarry mines development area and bedrock area by adding water to the mixture and mixing the same.

 The vegetation-based material for restoring quarry mines development
20 area and bedrock area comprises peat moss, perlite, steam exploded wood chip, defiberized pulp, soil stabilizer and water in weight ratio of (1.0 - 5.0) : (0.1 - 3.0) : (1.0 - 5.0) : (0.1 - 3.0) : (0.1 - 3.0) : (1.0 - 5.0) (w/w/w/w/w/w), but it is limited thereto, it is preferable that it comprises peat moss, perlite, steam exploded wood chip, defiberized pulp, soil stabilizer and water in weight ratio of

3 : 1 : 3 : 0.1 : 0.5 : 2.4 (w/w/w/w/w/w).

The steam exploded wood chip may be a residue produced by mixing at least one wood selected from the group consisting of oak, Sawtooth oak, Oriental white oak, Konara oak, Mongolian oak, Chinese cork oak and Daimyo oak in a form of a chip which is steam-exploded for 1 to 10 minutes with a steam of 1 to 10 kgf/cm² in ethanol in a ratio of 1 : (5-15) (w/w) and extracting with ethanol at 50 to 70 °C for 2 to 4 hours, but it is not limited thereto.

Hereinafter, the vegetation-based material for restoring quarry mines development area and the method of preparing the same will be described in more detail with reference to the following Examples. However, the present invention is not limited by these examples.

<Example 1> Preparation of vegetation-based material for restoring quarry mines development area

1. Preparation of raw materials

Raw materials used for preparing the vegetation-based material of the present invention include peat moss (LA FLORA Co.), perlite (Landscaping Korea, Co.), steam-exploded oak wood chip (Yurim Hitec, Co.), defiberized pulp (Murim paper, Co.) and soil stabilizer [carboxy methyl cellulose; hereinafter, referred to as 'CMC' (Ducksan Science, Co.), carboxy methyl starch; hereinafter, referred to as 'CMS' (Ducksan Science, Co.) and guar gum (Deoksan Science Co.)] and Table 1 shows the treatment methods after purchase of each raw material.

[Table 1]

No.	Raw material name	manufacturer	Treatment method
1	Peat moss	LA FLORA, Co.	Using after passing 2 mm sieve
2	Pearlite	Landscaping Korea, Co.	-
3	Steam-exploded oak wood chip	Yurim Hitec, Co.	Steam-explosion at 3 kg·f/cm ² for 3 minutes → a residue extracted with mixture of 10% ethanol in a ratio of 1:10 (w/v) at 60°C for 3 hours → Using after passing 2 mm sieve (refer to FIG. 1)
4	Defiberized pulp	Murim paper, Co.	
5	Soil stabilizer (CMC, CMS, Guar gum)	Ducksan Science, Co.	-
6	Water	-	Using tap water

2. Preparation of vegetation-based material for restoring quarry mines development area

A mixture of 3 kg of peat moss, 1 kg of perlite, 3 kg of steam-exploded and ethanol-extracted oak wood residue, 0.1 kg of defiberized pulp and 0.5 kg of CMC were prepared based on the air-dried weight.

2.4 kg of water (tap water) was added to the mixture and mixed for 15 minutes (industrial concrete mixer) to produce a vegetation-based material for restoring quarry mines development area (hereinafter, referred to as 'vegetation-based material 1') and the vegetation-based material for restoring quarry mines development area contained peat moss, perlite, steam-exploded and ethanol-extracted oak wood residue, defiberized pulp, CMC and water in a ratio by air-dried weight of 3: 1: 3: 0.1: 0.5: 2.4 (w/w/w/w/w).

In the case of the steam-exploded and ethanol-extracted oak wood

residue, chip oak was steam exploded for 3 minutes with 3 kgf/cm² of steam.

The steam-exploded chips were mixed with 10% ethanol at a ratio of 1:10 (w/w), extracted at 60 °C for 3 hours, and the extract residues were passed through a 2 mm sieve and the obtained was used for the following examples.

5

<Example 2> Preparation of vegetation-based material for restoring quarry mines development area

The vegetation-based material was prepared in the same manner as in Example 1 except that 0.5 kg of carboxy methyl starch (CMS, hereinafter referred to as 'CMS') was added instead of CMC, and peat moss, perlite, steam-exploded and ethanol-extracted oak wood residue, defiberized pulp, CMS and water was added in a ratio by air-dried weight of 3: 1: 3: 0.1 : 0.5 : 2.4 (w/w/w/w/w) (hereinafter, referred to as 'vegetation-based material 2').

15

<Example 3> Preparation of vegetation-based material for restoring quarry mines development area

The vegetation-based material was prepared in the same manner as in Example 1 except that 0.5 kg of guar gum (Ducksan Science, Co.) was added instead of CMC, and peat moss, perlite, steam-exploded and ethanol-extracted oak wood residue, defiberized pulp, guar gum and water was added in a ratio by air-dried weight of 3: 1: 3: 0.1 : 0.5 : 2.4 (w/w/w/w/w) (hereinafter, referred to as 'vegetation-based material 3').

<Comparative Example 1>

The vegetation-based material (hereinafter, referred to as 'vegetation-based material 0 ('control')) was prepared by mixing peat moss, perlite, steam-exploded and hot water-extracted oak wood residue and corrugated cardboard dissolution liquid in a ratio by air-dried weight of 3: 1: 3: 3 (w/w/w/w).

5

<Experimental Example 1> Evaluation of efficacy of preventing outflow of soil of vegetation-based material

1. Construction of soil outflow test apparatus and evaluation method of soil outflow prevention effect

10 The angle of the soil outflow test apparatus was set at 45 ° and the frame was made of wood with a size of 40 cm (W) × 50 cm (L) × 13 cm (H).

The soil (control) or vegetation-based material was filled in a frame of 40 cm (W) × 50 cm (L) × 13 cm (H).

15 The soil or vegetation base material was filled into a frame of 40 cm (W) x 50 cm (L) x 13 cm (H) and then hardened to a hardness of 0.5 mm.

The input contents of soil (control), vegetation-based material 0 (control), vegetation-based material 1, vegetation-based material 2 and vegetation-based material 3 were 31.8 kg, 6.1 kg, 5.8 kg, 5.9 kg and 6.1 kg, respectively.

20 Artificial rainfall (144 ml/min) was applied to a soil outflow test apparatus (see FIG. 2) into which a soil or vegetation-based material was introduced for 5 minutes and then the soil or vegetation-based material flowed out from the rectangular case equipped below the test apparatus was collected.

The outflow soil or vegetation-based material was dried for 3 days in a 60 °C in a drier and weighed to determine the soil outflow rate by the following

formula:

[Equation 1]

$$\text{Soil outflow ratio (\%)} = \frac{\text{Oven-dry weight of sample outflowed after artificial rainfall (g)}}{\text{Oven-dry weight of sample added into wooden frame (g)}} \times 100$$

5 2. Evaluation results of soil outflow prevention effect (soil outflow rate) of
vegetation-based material

FIG. 3 shows the soil outflow rate due to the artificial rainfall of soil (control), vegetation-based material 0 (control), vegetation-based material 1, vegetation-based material 2, and vegetation-based material 3, and FIG. 4 shows
10 the state after the soil outflow test.

The soil outflow rates of soil (control), vegetation-based material 0 (control), vegetation-based material 1, vegetation-based material 2 and vegetation-based material 3 were 9.72%, 3.51%, 0.23%, 0.19% and 0.07%, respectively.

15 Therefore, guar gum (vegetation-based material 3) is considered to be the most effective soil stabilizer for preventing soil outflow.

**<Experimental Example 2> Evaluation of physicochemical properties and vegetation characteristics of vegetation-based material of
20 aggregate or stone-based square frame**

1. Preparation of test soil

Soil for testing was prepared by inputting soil (control), vegetation-based material 0 (control), vegetation-based material 1, vegetation-based material 2

and vegetation-based material 3 into rectangular frames of (20 cm (W) x 20 cm (L) x 7 cm (H)) based on aggregate or stone, respectively.

FIG. 5 shows the method of preparing the test land based on the granite type (aggregate and stone) which vegetation-based material was applied.

5 The test land according to the granite type and the mixing ratio of soil and vegetation-based material were prepared at the location of 1056-1, Gajwadong, Jinju-si, Gyeongsangnam-do and the plants on the ground were removed for preparing the granite.

10 After removing the plants on the ground, the frame was fixed on the ground, and then the aggregate and stone were added into each frame, and the vegetation-based material 1, the vegetation-based material 2 and the vegetation-based material 3 were introduced. At this time, the vegetation-based material was hardened to have a hardness of 0.5 mm.

15 Table 2 and FIG. 6 show the method of preparing the test land which vegetation-based material is applied according to the granite type, and FIG. 7 shows the state after completion of the test land which vegetation-based material is applied according to the granite type.

[Table 2]

Step	contents
Step 1	Ground clearance
Step 2	Preparation of square frame and granite ground of aggregate or stone
Step 3	Addition of vegetation-based material
Step 4	Seed sowing
Step 5	Moisture supply

20 2. Officially noticed seed

Officially noticed seeds are bush clover, false indigo, evening primrose and Chinese bush clover, and bush clover and false indigo are woody plants, and evening primrose and Chinese bush clover are herbaceous plants. 300 seeds of each of four seeds were mixed and seeded per test section.

5 [Table 3]

No.	Seed name	Scientific name	구분
1	Bush clover	<i>Lespedeza cyrtobotrya</i>	Woody plant
2	False indigo	<i>Indigofera pseudotinctoria</i>	Woody plant
3	Evening primrose	<i>Oenothera biennis</i>	herbaceous plant
4	Chinese bush clover	<i>Lespedeza cuneate</i>	herbaceous plant

3. Evaluation of physical and chemical properties

(1) Hardness

10 The hardness of the sample was measured in one month after the preparation of the test soil in a small scale port using a Yamanaka-type soil hardness meter and the result is shown in FIG. 8.

15 In the aggregate-based test soil, soil (control), vegetation-based material 0 (control), vegetation-based material 1, vegetation-based material 2 and vegetation-based material 3 were 6.25, 4.58, 4.17, 3.21, and 1.38 mm, respectively. In the stone-based test soil, soil (control), vegetation-based material 0 (control), vegetation-based material 1, vegetation-based material 2 and vegetation-based material 3 were 6.88, 4.79, 4.17, 2.25, and 1.75 mm, respectively.

20 It was confirmed that the hardness of aggregate base and stone base was low in vegetation based 1, vegetation based 2 and vegetation based 3

mixed with soil stabilizer than that of soil (control) or vegetation based 0 (control).

In particular, the vegetation-based material 3 exhibited the lowest hardness, and it is presumed that because the low hardness has a favorable effect on the plant growth due to the smooth ventilation and easy transfer of organic matter, vegetation-based material 3 has a positive impact on plant growth.

According to the Landscape Design Standards of the Korean Institute of Landscape Architecture (2007), the hardness belonging to the upper grade is less than 21 mm, and soil (control), vegetation-based material (control), vegetation-based material 1, vegetation-based material 3 were confirmed to correspond to the upper grade.

(2) Temperature

The temperature of the soil and vegetation-based material according to a granite type was measured in a small scale port using a soil thermometer and the results are shown in FIG. 9.

In the aggregate-based test soil, soil (control), vegetation-based material 0 (control), vegetation-based material 1, vegetation-based material 2 and vegetation-based material 3 exhibited temperatures of 31.99, 31.61, 30.19, 29.93, and 29.64 °C, respectively. In the stone-based test soil, soil (control), vegetation-based material 0 (control), vegetation-based material 1, vegetation-based material 2 and vegetation-based material 3 showed temperature of 32.33, 31.45, 30.45, 29.88, and 29.70 °C, respectively.

Based on the above results, the vegetation-based material 3 in the aggregate-based and stone-based test soils showed the lowest temperature significantly.

Ground surface temperature is a factor that directly affects the growth of plants. When the greenery or ecosystem restoration site is based on rocks with high thermal conductivity, many plants are dead dry due to the rapid increase of ground temperature due to high temperature in summer. It is therefore important to maintain a constant temperature.

When the temperature was measured in July, generally showing a high atmospheric temperature in one year, it is assumed that the vegetation-based material 3, which exhibited a low temperature, would be advantageous for plant growth.

(3) Moisture

The moisture content of the vegetation-based material according to a granite type in one month after the preparation of the test soil in a small scale port using a soil moisture meter and the result is shown in FIG. 10.

The moisture content of vegetation-based material 3 was significantly higher in both aggregates and stones than the soil (control) and vegetation-based material 0 (control).

Considering that the moisture content favorable for plant growth is generally 40-50%, vegetation-based material 3 is considered to be suitable for the plant growth.

Moisture content is one of the most important factors for plant growth,

and it affects plant growth by moisture evaporation due to high temperature in summer.

Especially, in the case of vegetation area based on bedrock, it is not only difficult to maintain moisture, but also water content is important because water evaporation occurs actively. Therefore, it was confirmed that the vegetation-based material 3 showing high moisture content is favorable for greening in the quarry mines development area.

(4) Evaluation of growth and development characteristics

1) Evaluation method of plant cover rate

Regarding ground coverage rate, total area of test port was photographed by using a digital camera and the green coverage was extracted using Photoshop (Adobe CS5).

The formula of the ground coverage rate is shown in Equation 2.

[Equation 2]

$$\text{Ground coverage rate (\%)} = \frac{\text{Green area (m}^2\text{)}}{\text{Total area of test port (m}^2\text{)}} \times 100$$

2) Results of evaluation of growth and development characteristics of vegetation-based material (ground coverage rate of seeds)

FIG. 11 illustrates the ground coverage rate of the vegetation-based material according to the type of granite, showing the change of the ground coverage rate with passing the test period.

Although the vegetation-based material 0 (control) showed the highest ground coverage rate in the aggregate-based square frame, the vegetation-based material 3 showed the highest ground coverage rate in the stone-based square frame.

5 Based on the above results, it was confirmed that the vegetation-based material 3 could be utilized as a base material for vegetation in the stone materials which are distributed in most quarry mines development area.

**<Experimental Example 3> Evaluation of physicochemical
10 properties and growth and development characteristics according to
application of vegetation-based material of site in quarry mines
development area**

1. Preparation of test soil

A square frame (1 m (W) × 1 m (L) × 5 cm (H)) was used for the
15 formation of a vegetation-based material in the quarry mines development area.

The soil was used as a control, and soil (control), vegetation-based material 1, vegetation-based material 2 and vegetation-based material 3 were poured to a square frame having a height of 5 cm and hardened to have hardness of 0.5 mm and the above procedure was repeated twice (See FIG. 12).

2. Officially noticed seed

20 Officially noticed seeds are bush clover, false indigo, evening primrose and Chinese bush clover, and bush clover and false indigo are woody plants, and evening primrose and Chinese bush clover are herbaceous plants. 1,500

seeds of each of four seeds were mixed and seeded per test section.

3. Evaluation of physicochemical property of vegetable-based materials

(1) Salt concentration

The salt concentration was measured according to the 'salt concentration measurement method' of the 'soil and plant analysis method (2010)' of the National Institute of Agricultural Science and Technology, Rural Development Administration and calculated by the following Equation 3 and the results are shown in FIG. 13.

[Equation 3]

Salt concentration (dS/m) = Electrical conductivity X Temperature correction coefficient

Specifically, referring to FIG. 13, it was confirmed that the salt concentration of the soil (control) and vegetation-based material 3 was equal to and less than 60%, at which the plant growth was not adversely affected.

Soil and vegetation-based material 3 is considered to be suitable as a base material for plant growth because high salinity concentration has a problem of causing dry death of the plant due to osmotic action.

(2) Organic matter content

Organic matter content was measured according to the method of 'determination method of organic matter content' of 'standard analysis method of bed soil (2002)' of the National Institute of Agricultural Science and

Technology, Rural Development Administration.

The air-dried sample was dried in a 105 °C dryer for 16 hours and then put into a crucible weighed 2 g of oven dry weight, and the crucible into which the sample was added was completely burned in an electric furnace at 550 °C for 6 hours, and the weight was weighed (Equation 4) and the results are shown in FIG. 14.

[Equation 4]

$$\text{Organic matter content (\%)} = 100 - \frac{\text{Carbonated sample weight at 550}^\circ\text{C}}{\text{Dry sample weight at 105}^\circ\text{C}}$$

Specifically, referring to FIG. 14, the organic matter content is a factor that directly affects the nutrient supply of the plant, and generally the plant smoothly grows in the base material showing an organic matter content of at least 80%.

A vegetation-based material 3 containing guar gum showed the highest organic matter content, and vegetation-based materials 1 and 2 also showed high organic matter content of at least 80%.

Therefore, vegetation-based material 1, vegetation-based material 2, and vegetation-based material 3 except for soil (control) were found to be favorable for plant growth.

(3) Evaluation of ground coverage rate of plants

1) Evaluation method

For the ground coverage rate, total area of the test port was measured using a digital camera and the green portion was extracted using Photoshop (Adobe CS5).

The formula of the ground coverage rate is shown in Equation 2.

[Equation 2]

$$\text{Ground coverage rate (\%)} = \frac{\text{Green area (m}^2\text{)}}{\text{Total area of test port (m}^2\text{)}} \times 100$$

2) Evaluation results of growth and development characteristics of vegetation-based material (ground coverage rate of officially noticed seed)

The coverage rate of the ground was measured for evaluating the plants growth of vegetation-based material 1, vegetation-based material 2, and vegetation-based material 3, and the highest cover rate was shown in vegetation-based material 3 (see FIG. 15).

Therefore, it is concluded that the vegetation-based material 3 mixed with guar gum as a soil stabilizer is considered to be the optimum condition for the greening of the site in the quarry mines development area, and it was confirmed that it is most effective in mitigating soil outflow for smooth vegetation in a special place with a slope in the quarry mines development area.

Therefore, the vegetation-based material for greening in the quarry mines development area comprising peat moss, perlite, steam-exploded and ethanol-extracted oak wood residue, defiberized pulp, guar gum and water at weight ratio of 3: 1: 3: 0.1: 0.5: 2.4 (w/w/w/w/w) is considered to be the optimum

composition.

INDUSTRIAL APPLICABILITY

When the vegetation-based material according to the present invention is applied to a special place having a slope in the quarry mines development area and bedrock area, it is possible to promote the early graft-take and rapid growth of the plant and stabilize the slope due to the effect of mitigating the soil outflow for smooth vegetation.

While the present invention has been particularly shown and described with reference to exemplary embodiments thereof, it is to be understood that the invention is not limited to the disclosed exemplary embodiments. It will be apparent to those skilled in the art that various modifications and changes may be made without departing from the scope of the appended claims.

WHAT IS CLAIMED IS:

1. A vegetation-based material for restoring quarry mines development area, comprising peat moss, perlite, steam exploded wood chip, defiberized pulp, guar gum and water in weight ratio of 3 : 1 : 3 : 0.1 : 0.5 : 2.4 (w/w/w/w/w/w),

wherein the steam exploded wood chip is a residue produced by mixing at least one wood selected from the group consisting of oak, Sawtooth oak, Oriental white oak, Konara oak, Mongolian oak, Chinese cork oak and Daimyo oak in a form of a chip which is steam-exploded for 1 to 10 minutes with a steam of 1 to 10 kgf/cm² in ethanol in a ratio of 1 : (5-15) (w/w) and extracting with ethanol at 50 to 70 °C for 2 to 4 hours.

2. A method of preparing a vegetation-based material of claim 1 for restoring quarry mines development area comprising:

preparing a mixture by mixing peat moss, perlite, steam exploded wood chip, defiberized pulp and soil stabilizer; and

producing a vegetation-based material for restoring quarry mines development area by adding water to the mixture and mixing the same.

DRAWINGS

FIG. 1

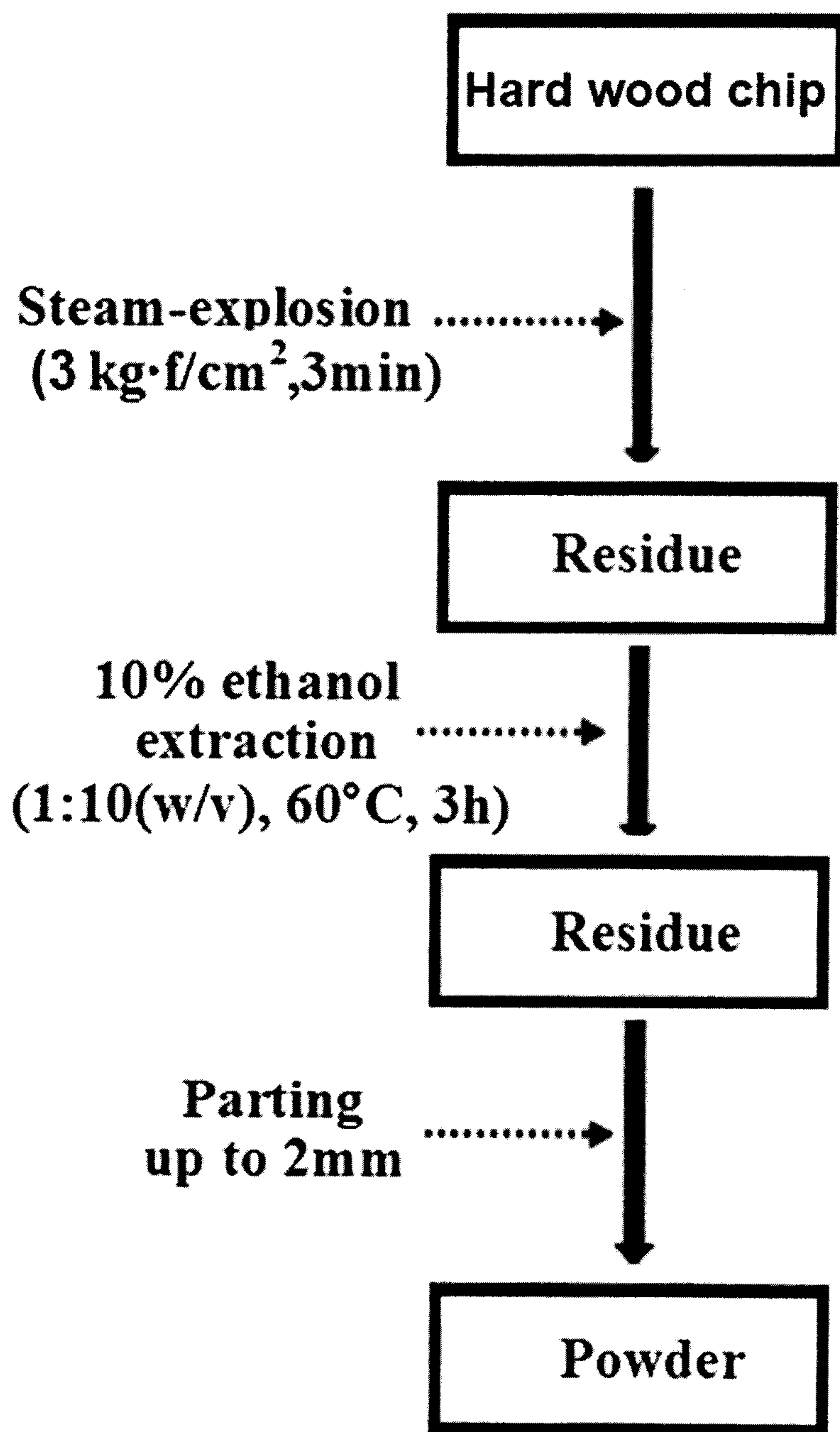


FIG. 2

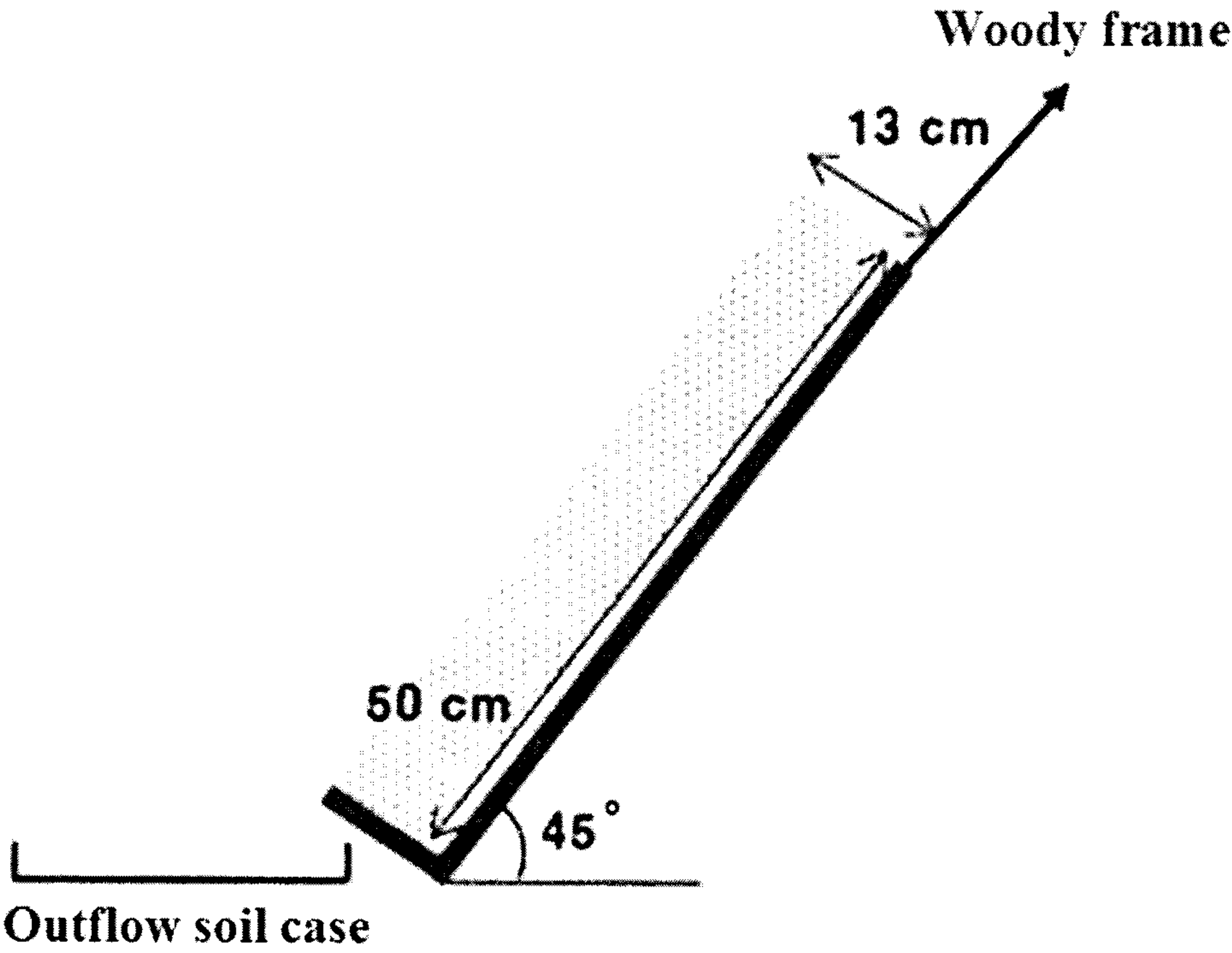


FIG. 3

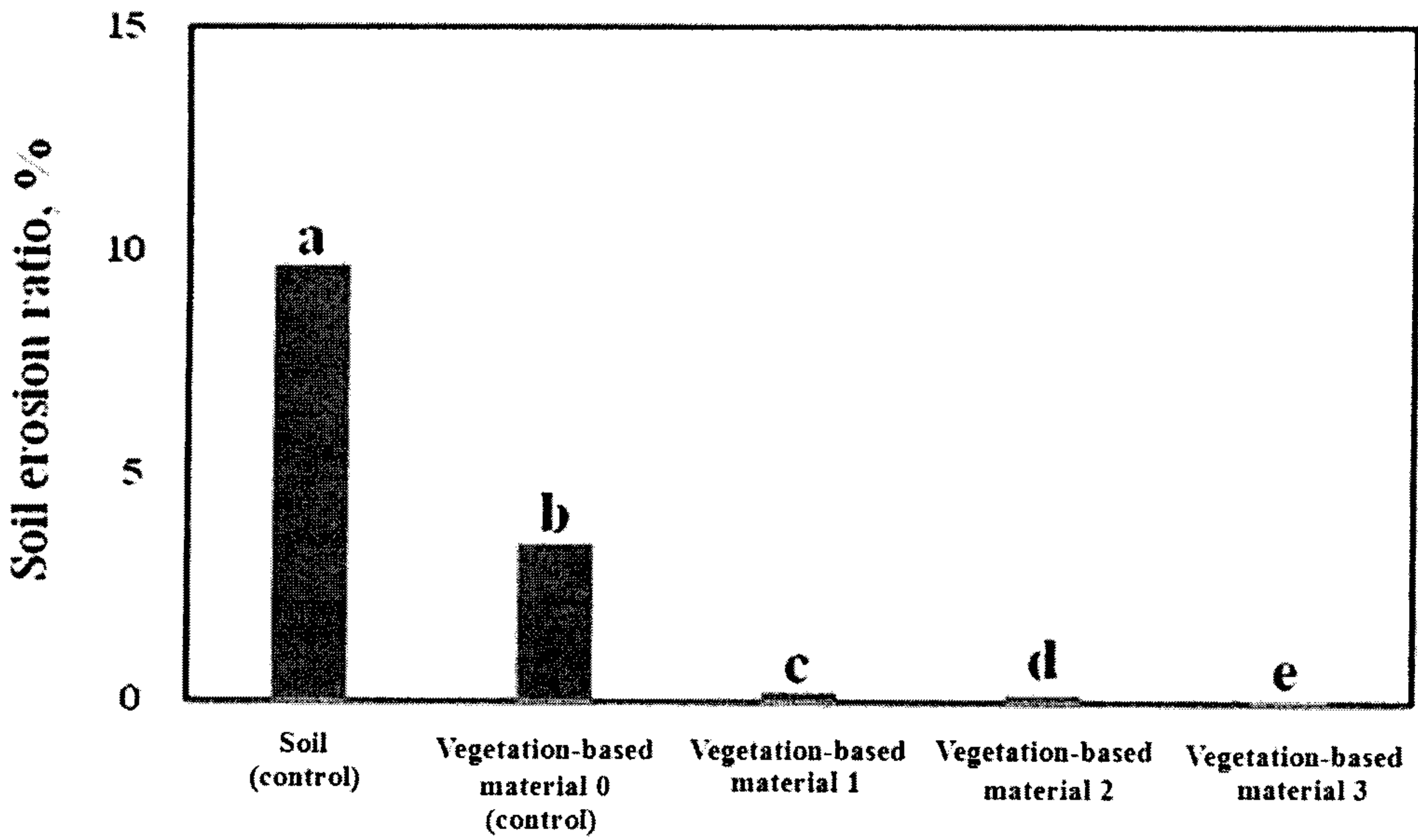


FIG. 4

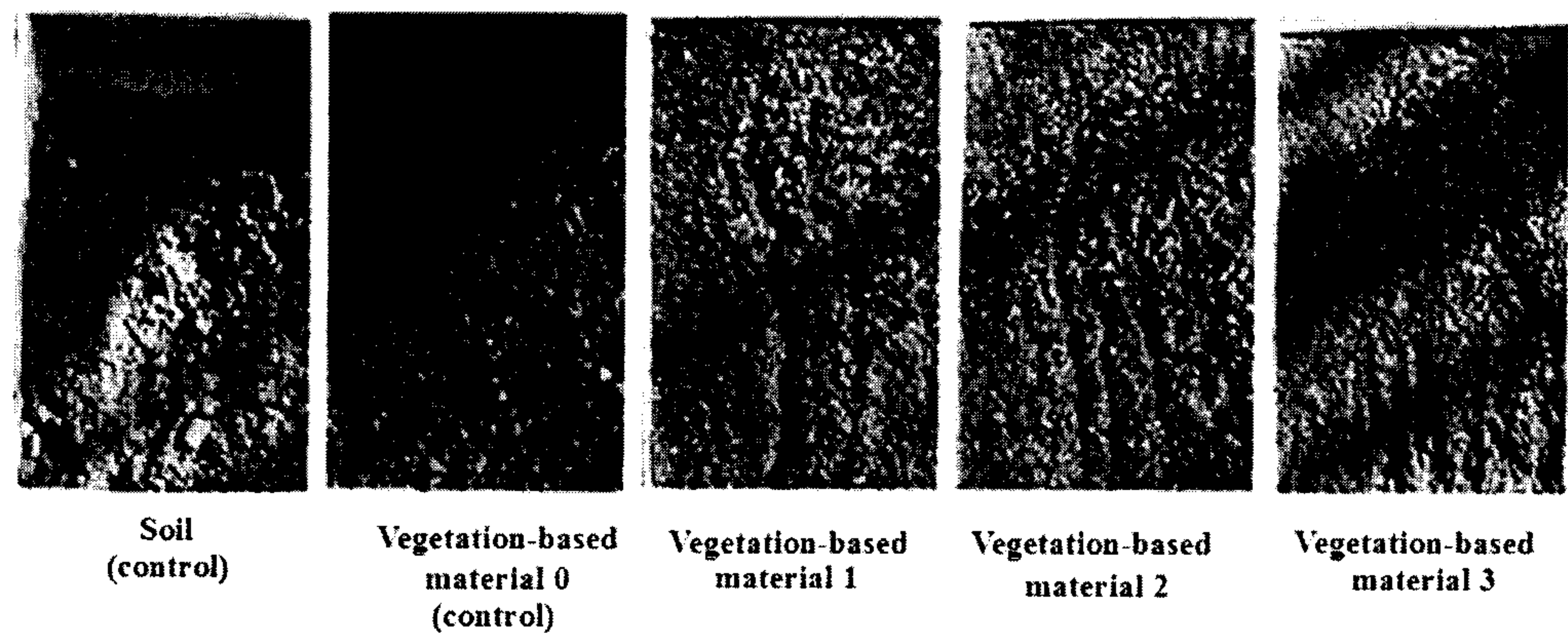


FIG. 5

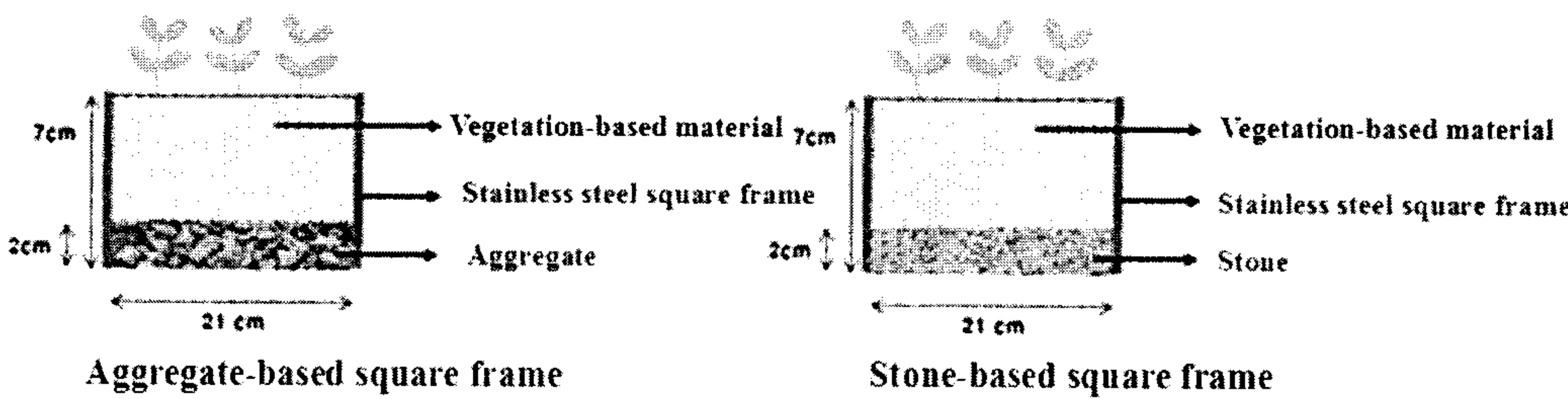


FIG. 6

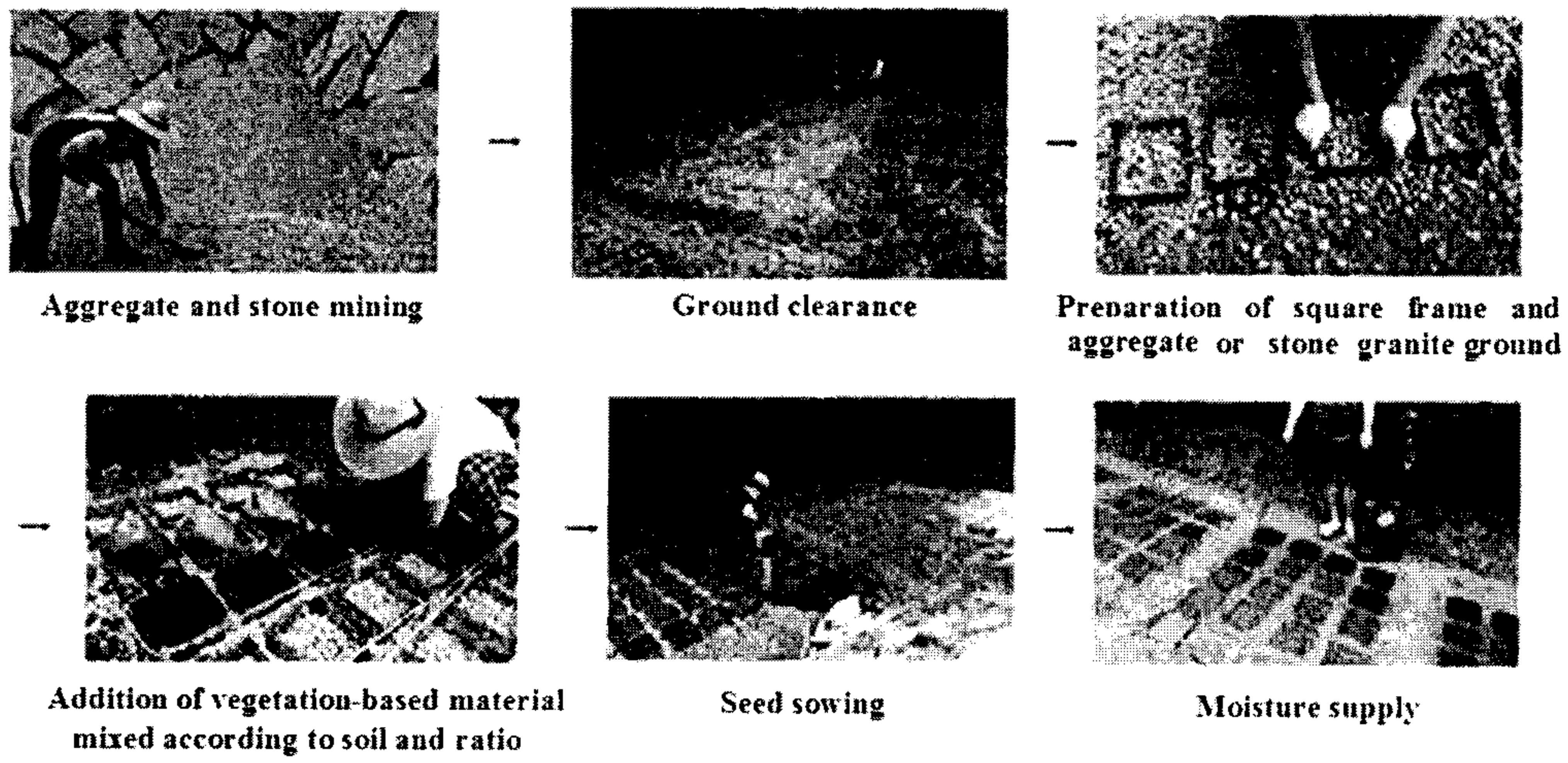


FIG. 7



FIG. 8

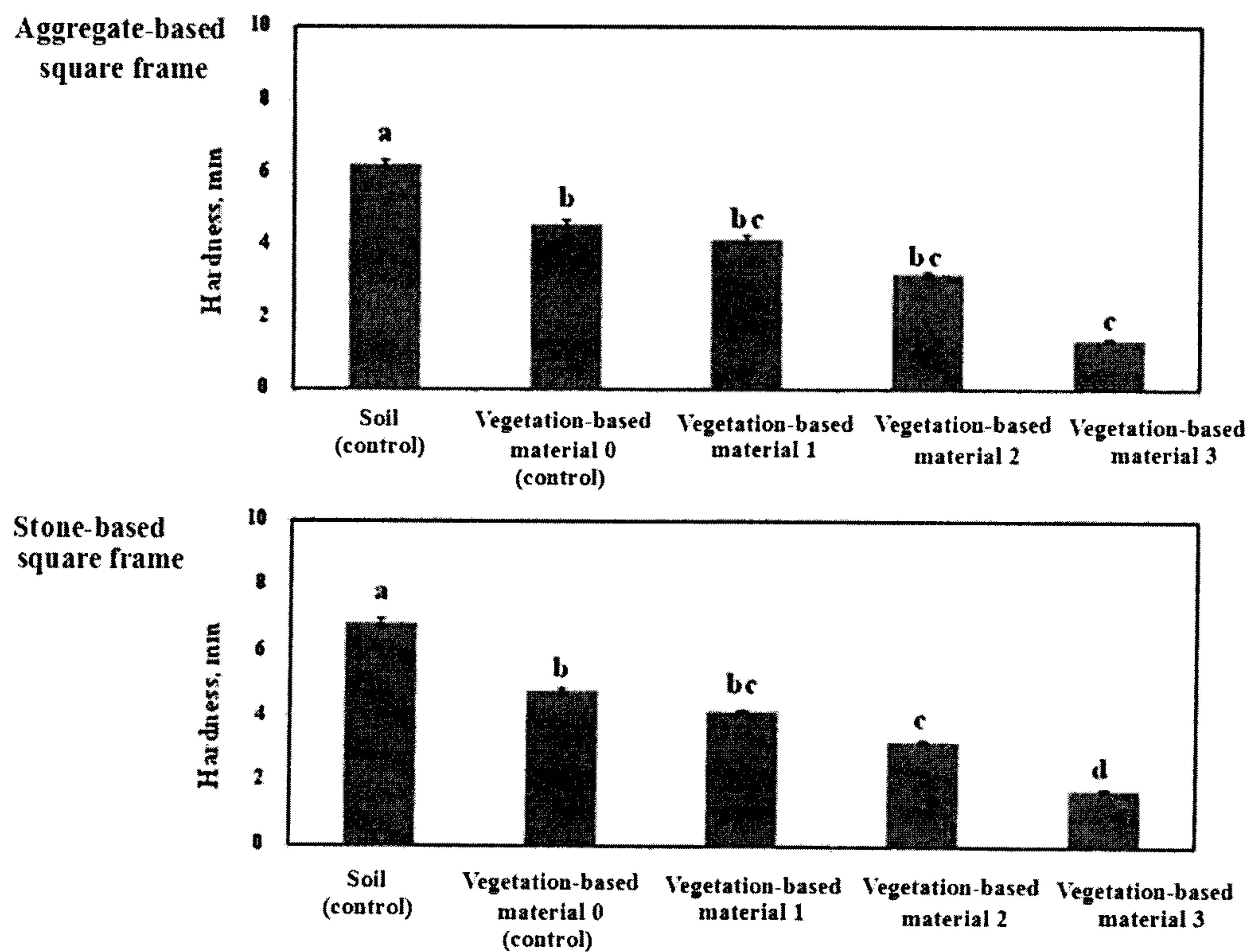
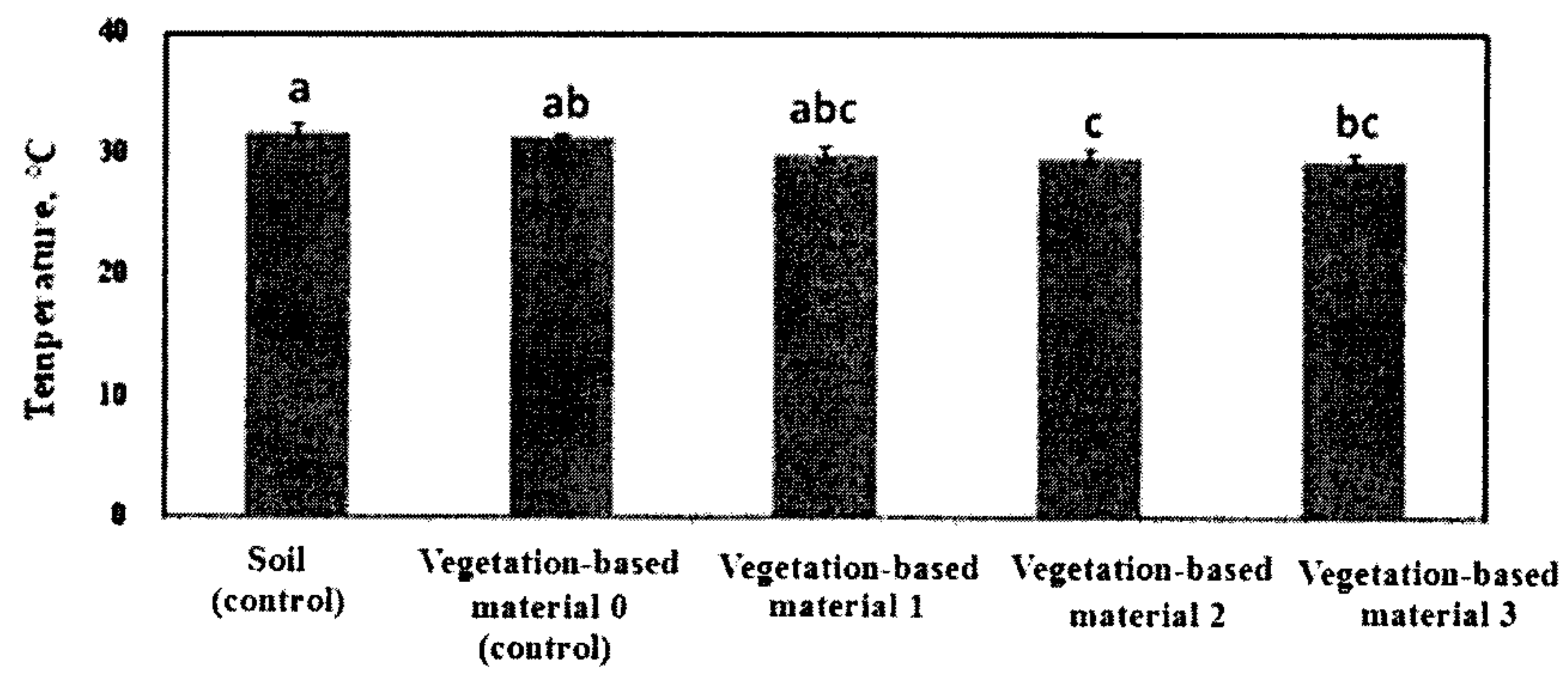


FIG. 9

Aggregate-based
square frame



Stone-based
square frame

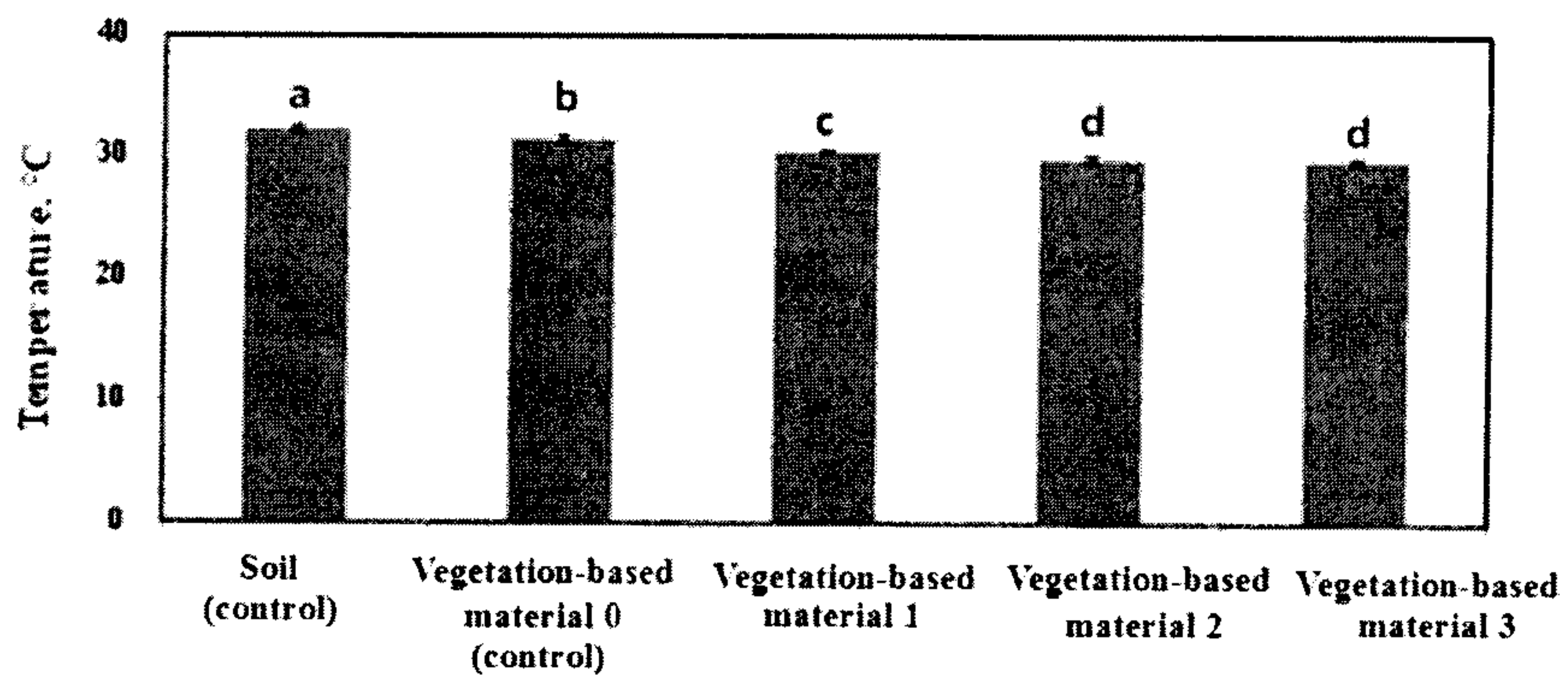
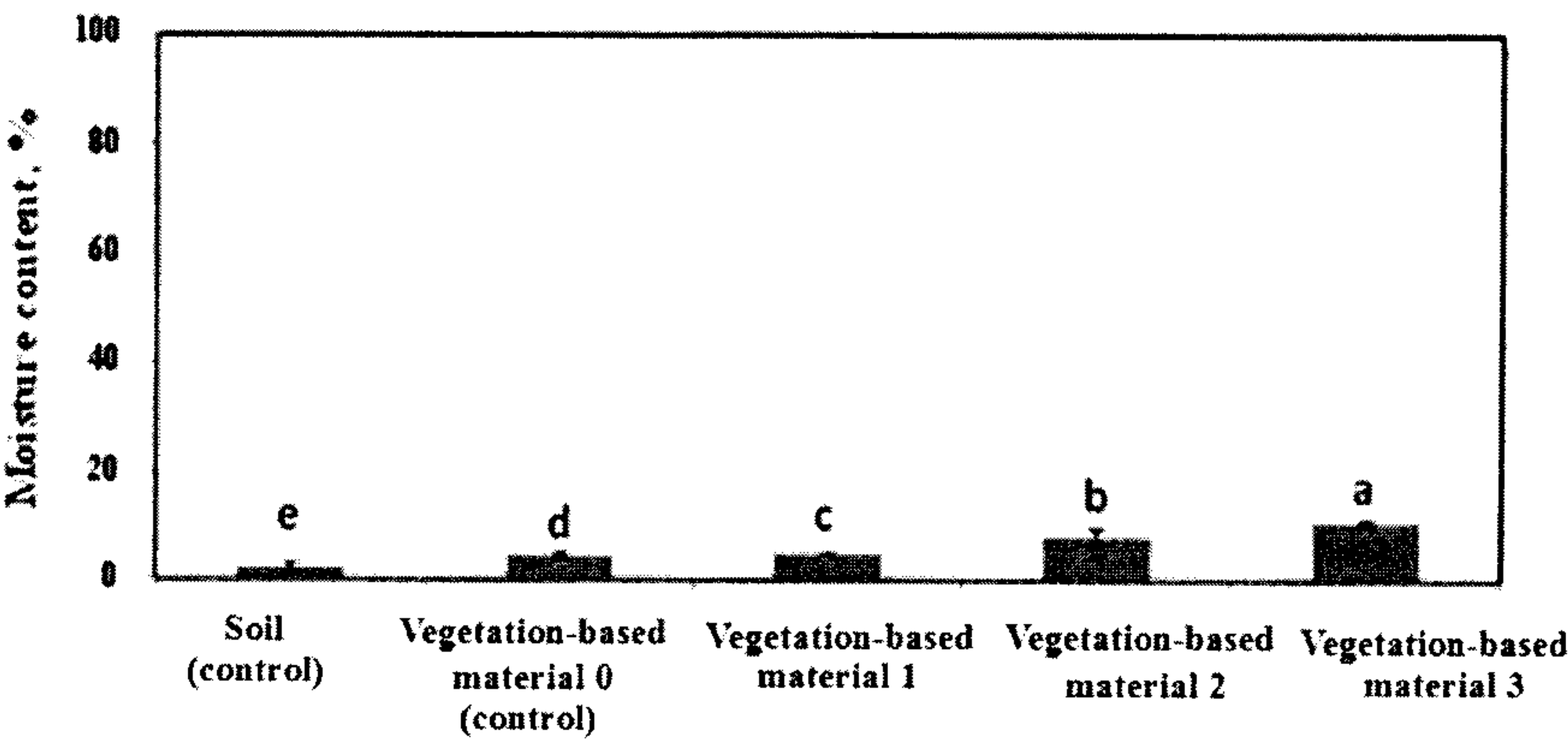


FIG. 10

Aggregate-based
square frame



Stone-based
square frame

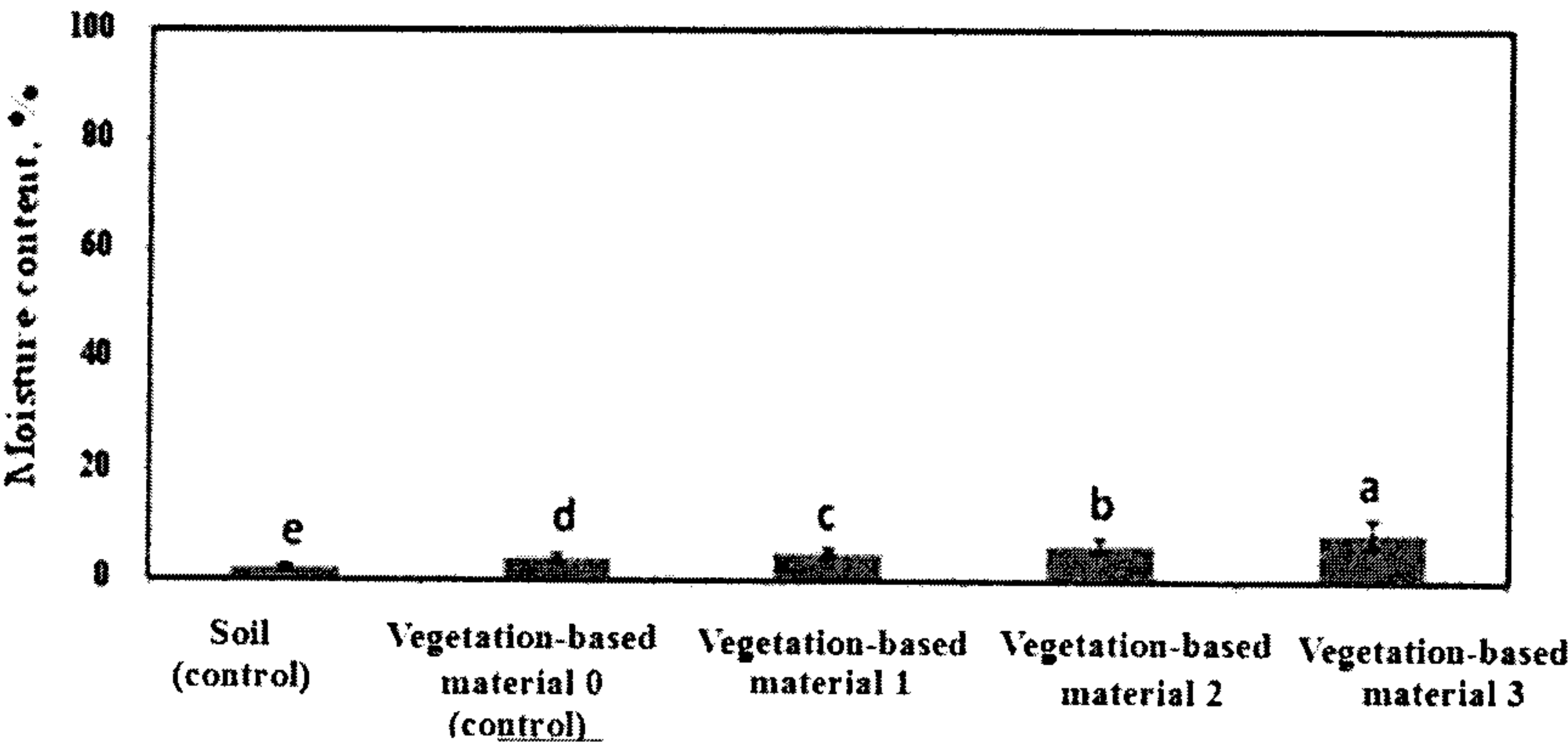
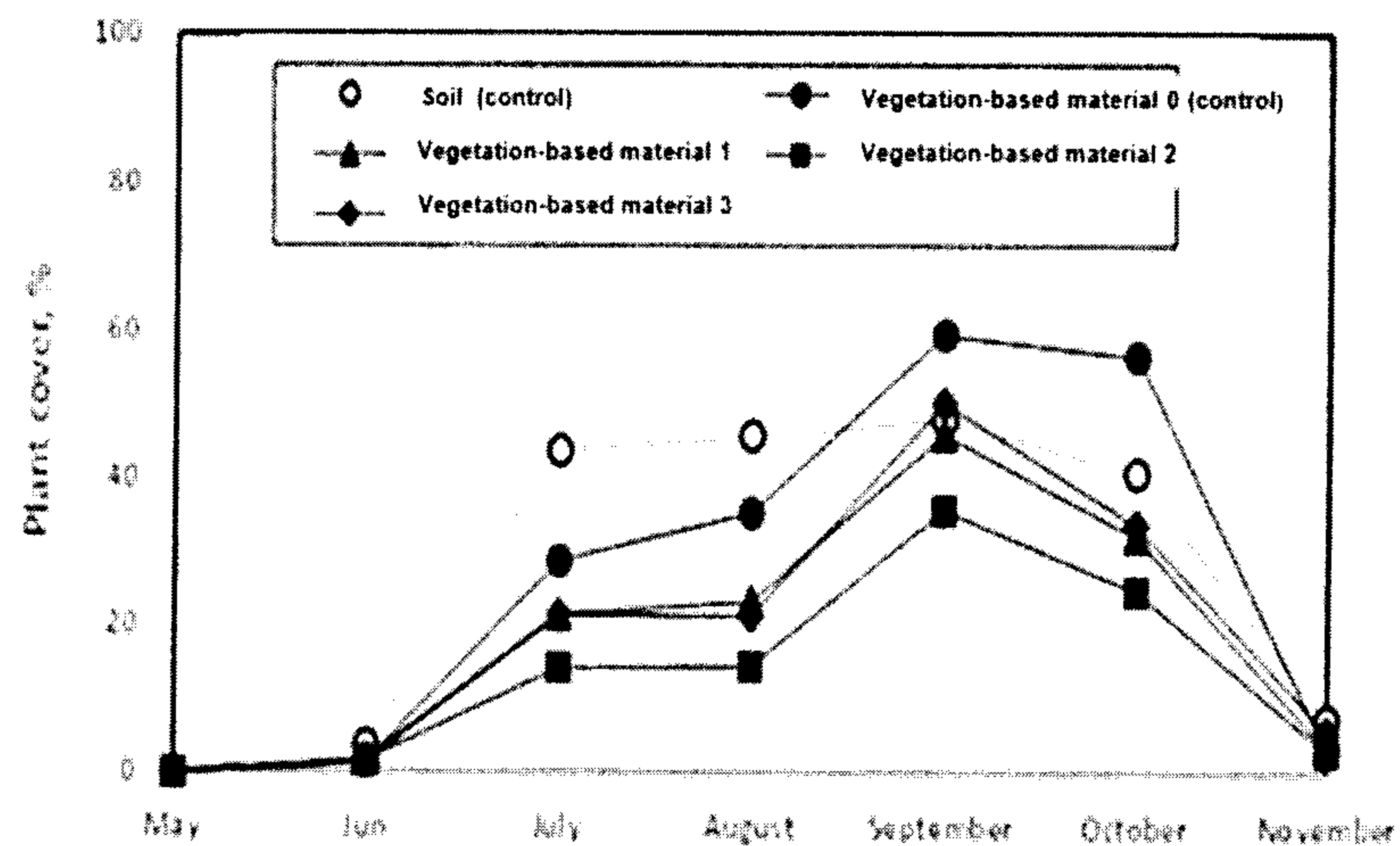


FIG. 11

**Aggregate-based
square frame**



**Stone-based
square frame**

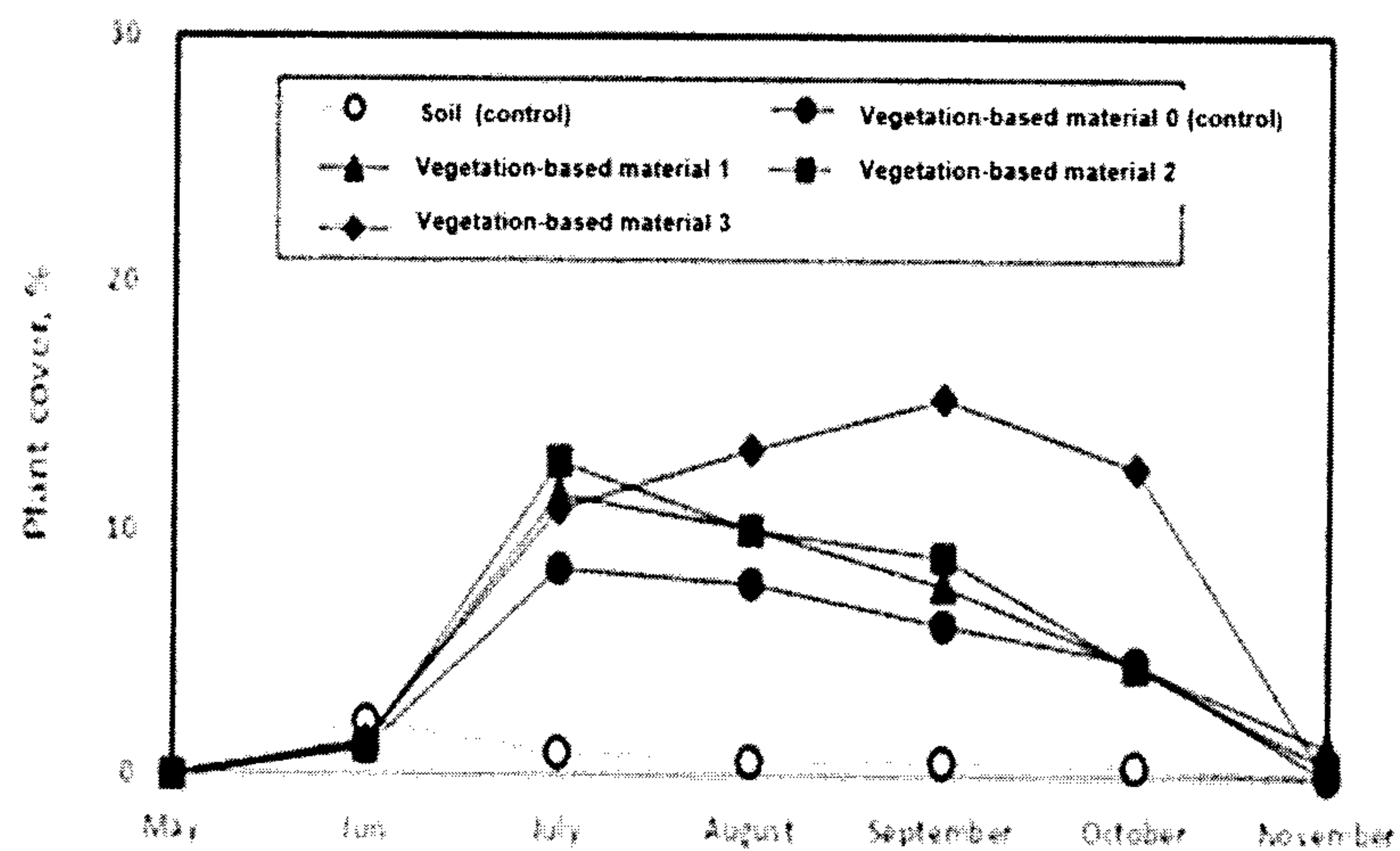


FIG. 12

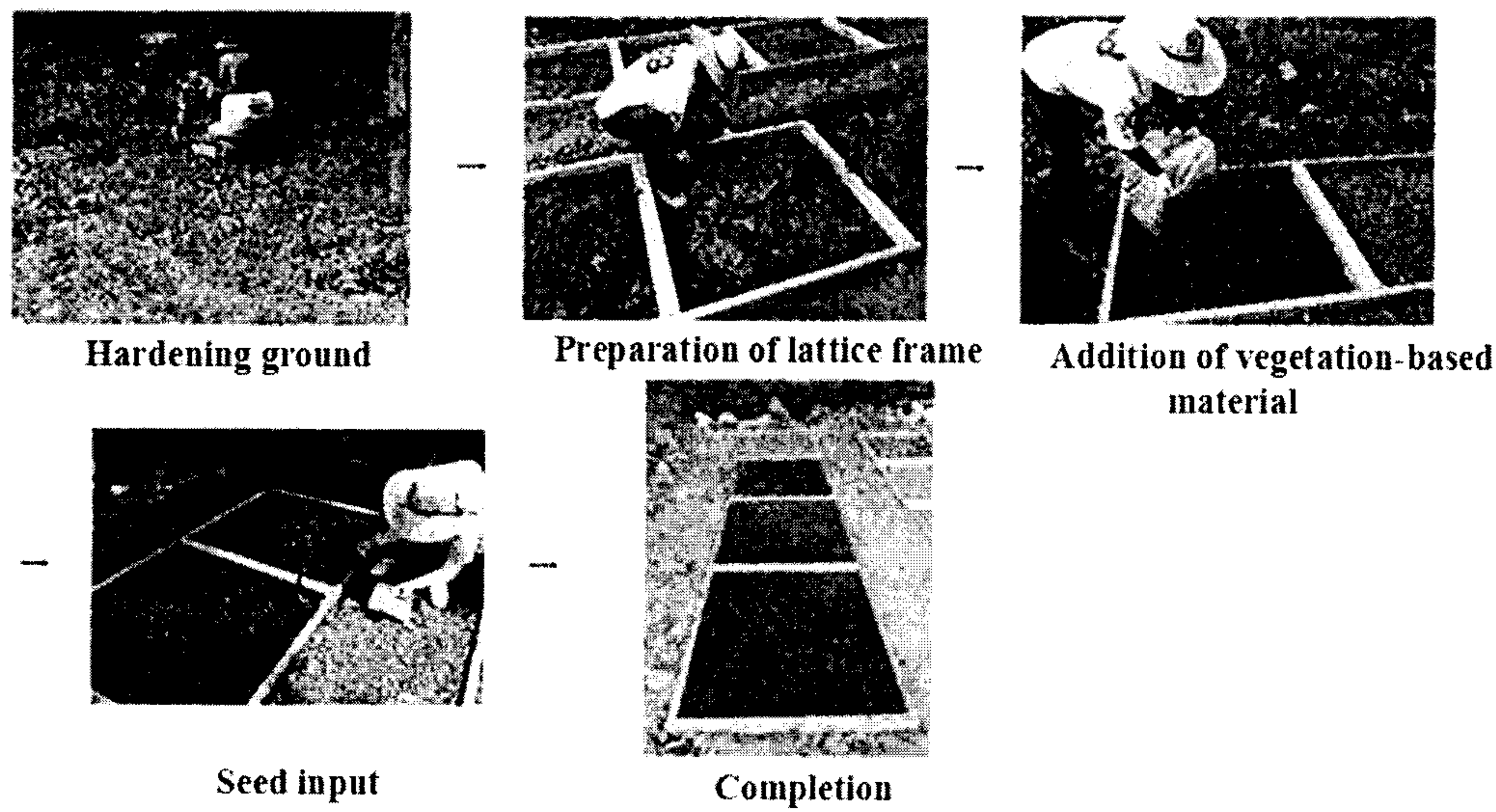


FIG. 13

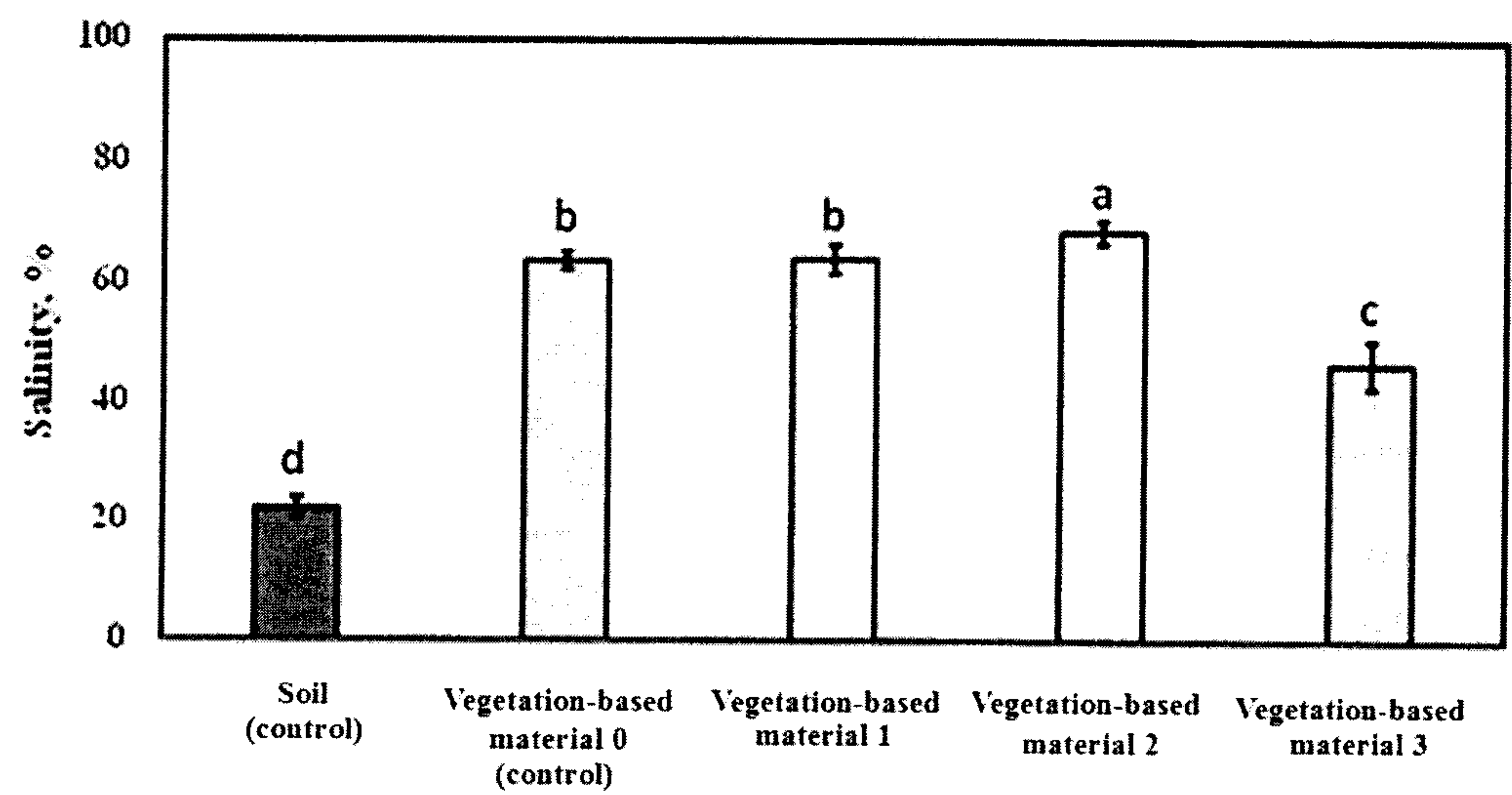


FIG. 14

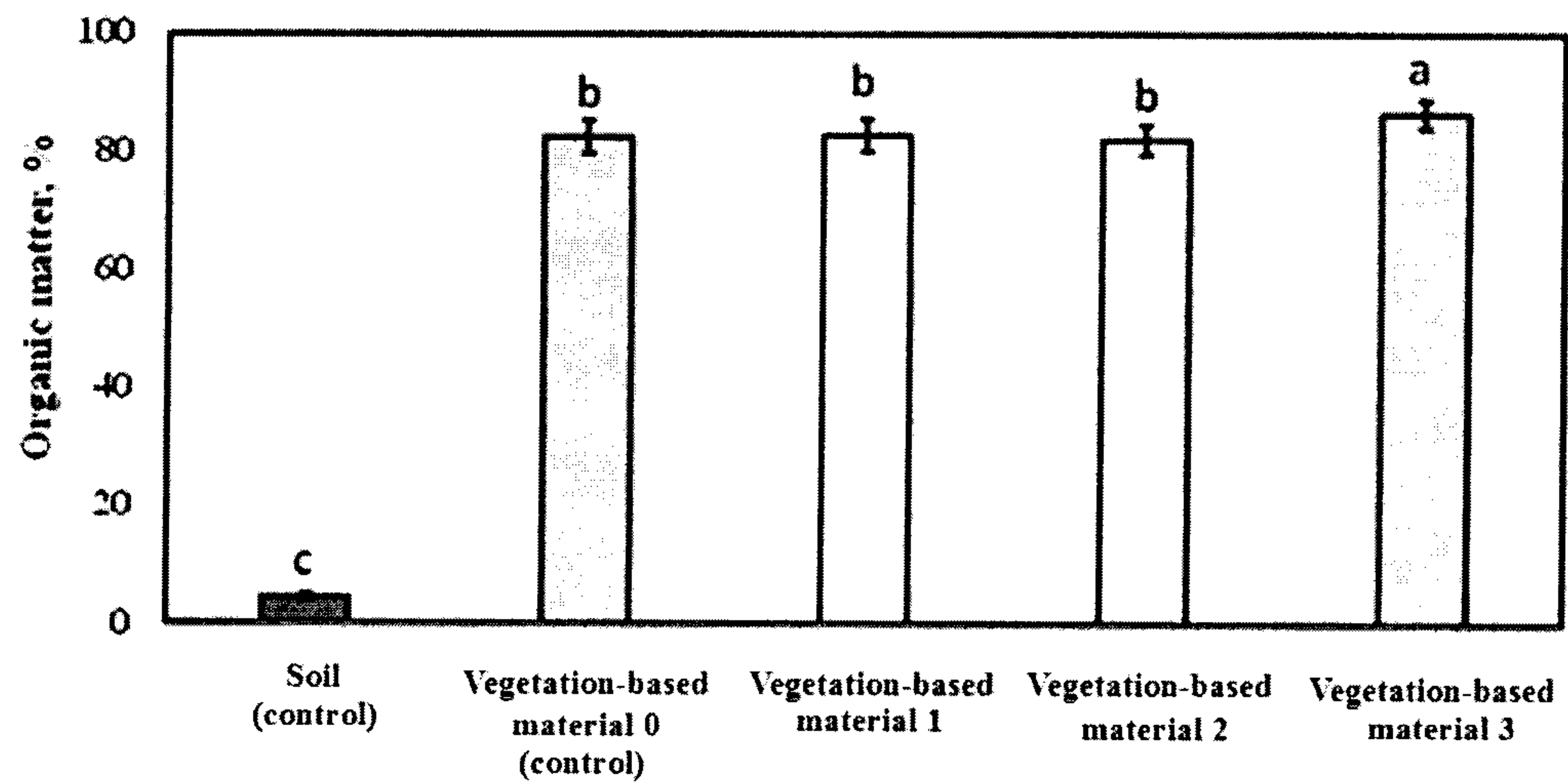


FIG. 15

