

# Applicability Assessment of the Expanded Waste Glass Material as Planting Basis Using Ground-Based Remote Sensing

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**Abstract:** The expanded waste glass material is one of the recycling materials. We investigated whether the expanded waste glass material is useful as planting basis and effective as heat insulation. We examined the difference of the materials by using vegetation index and temperature. The combination of the improved soils and the improved glasses marked higher vegetation index than other mixture materials. Moreover, this combination material is excellent than other ones to heat insulation. Therefore, it suggests that the expanded waste glass material has high potential to be used as a material for planting basis.

**Keywords:** Remote sensing, Glass Vegetation activity,

## 1. Introduction

The expanded waste glass material is one of the recycling materials, which has lightweight and high water holding capacity because of its porous characteristics. The representative use of this material is planting basis for which lightweight and easy maintenance are required.

In this study, we attempted to analyze the radiation temperature and the vegetation activity for four cases in which the normal/improved glasses and soils are combined. We observed all the cases by using a thermal infrared camera and a spectrum photometer, both of which are observation equipments based on the ground-based remote sensing.

## 2. Material and Method

### 1) The Characteristics of the Expanded Waste Glass Material

The expanded waste glasses material is the material that shattered waste glasses is burned and expanded with additions on 900 of temperature. Thus it is

**Table 1. Characteristics of The expanded waste glass material**

Characteristics	Value
Density(g/cm <sup>3</sup> )	0.3 ~ 0.6
Diameter of a gain(mm)	0.075 ~ 20
Permeability (cm/s)	$9.01 \times 10^{-3} \sim 1.12 \times 10^{-2}$

lightweight as it has very porous characteristics. Table 1 shows the characteristics of the expanded waste glass materials on the experiments. The density of the expanded waste glass materials is smaller than the normal soils (The density of normal soil is 2.5-2.8 g/cm<sup>3</sup>). Thus the expanded waste glasses are useful as materials on the roof garden at urban area. And the permeability of the expanded waste glasses is as same as sand.

### 2) The Material for Planting Basis

Fig. 1 shows target of survey and Fig. 2 shows combinations of soils and glasses. Improved soils are combined with the expanded waste glass material.

### 3) The Method of Survey

We investigated the vegetation index and temperature on the materials of planting basis. First, we measured the reflectance of survey point by using photometer, and the vegetation index is analyzed as the following equation.

$$NDVI = (NIR - VIS) / (NIR + VIS)$$

Where, NDVI is the normalized difference vegetation index, NIR is the reflectance of 850nm and VIS is the reflectance of 650nm.

Secondly, we investigated the radiation temperature by using thermal infrared camera, and the distribution of surface temperature of the materials for planting basis. Finally, we directly observed the temperature of

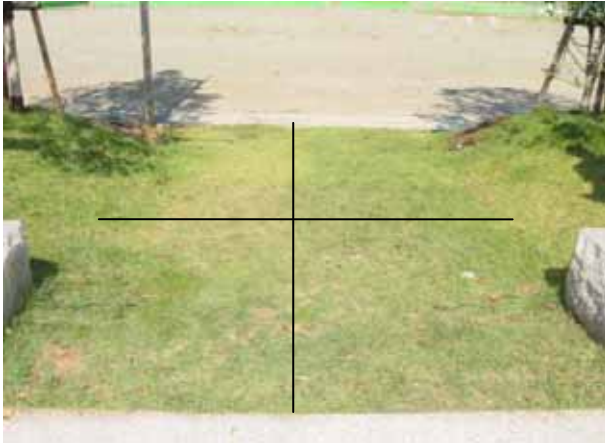


Fig. 1. The target of the survey (September 20, 2002)

The normal soils / The improved glasses	The improved soils / The improved glasses
The normal soils / The normal glasses	The improved soils / The normal glasses

Fig. 2. Combinations of soils and glasses

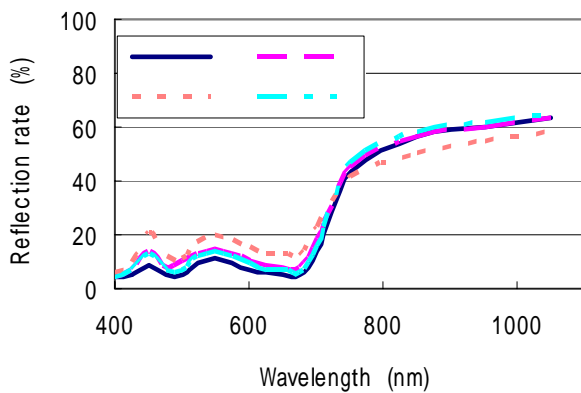


Fig. 3. The spectrum reflection for each case (September 20, 2002)

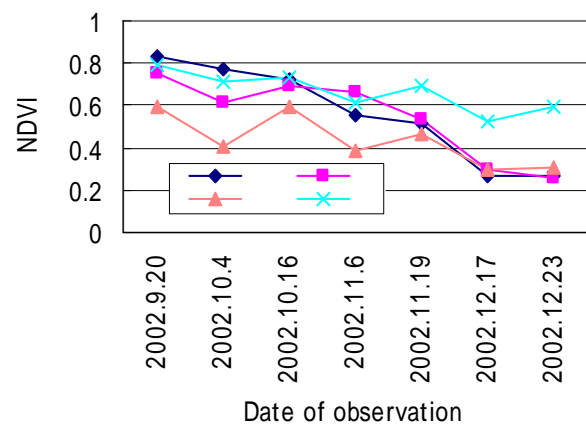


Fig. 4. Fluctuations of NDVI for each case with the data of observation

planting basis by using printing thermometer.

### 3. Result and Discussion

#### 1) The Situation of Vegetation

Fig. 3 shows a characteristic of the spectrum reflection for each case on September 20, 2002 and Fig.

4 show the time changing of NDVI for each case on the data of observation. We selected the observing point as representative point for each case.

If a vegetation index is higher, reflectance of 650nm is lower and reflectance of 550nm and 1050nm are higher. Thus vegetation activities for all cases are higher on September 20, 2002.

NDVIs for all cases are higher on September 20, 2002 because it is suitable for the plants are overgrowing at warm time. NDVIs for all cases are gradually lower as it becomes to winter. But the case of No. 4 (the mixture material of the improved soils and the improved glasses) marked higher average of NDVI than the other

case. Therefore this mixture material influenced well to keep higher vegetation activity.

#### 2) The Temperature of Panting Basis

Fig. 5 shows an example of the radiation temperature by using a thermal infrared camera. It was taken on September 20, 2002 at 9:59 am.

The case of the No. 4 (the combination of the improved soils and the improved glasses) marked lower level of the radiation temperature than the other case. It is considerable that the combination of the improved soils and improved glasses influences well for the vegetation index of glasses.

Fig. 6 shows continuous changes of surface temperature on September 20, 2002. We selected the observing point as representative point for each case.

The case of the No.4 (the combination of the improved soils and the improved glasses) marked lower level of touching temperature than the other case.



Fig. 5. One of the examples of the distribution of the radiation temperature (September 20, 2002 at 9:59 am)

### 3) Discussion on the Expanded Waste Glass Material

The case of No.4 (the combination of the improved soils and the improved glasses) marked lower level of the radiation temperature and the surface temperature by using a thermal infrared camera and a thermometer. This combination material is not easy to be warm and cool. Therefore this combination material is excellent than the other ones to heat insulation.

There is a little difference of NDVI on September 20, 2002 between all cases. But there is obvious difference of NDVI in winter that a vegetation activity is usually lower.

For these, the combination of the improved soils and the improved glasses is effective for planting basis.

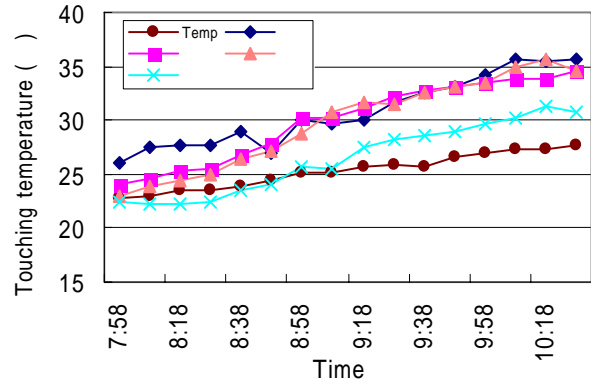


Fig. 6. Continuous changes of touching temperature (September 20, 2002)

### 4. Conclusion

In this study, it is apparent that using the planting basin combined with the expanded waste glass material is better than using the normal soil. Thus the planting basin is useful as applicability assessment of the expanded waste glass material.

From now on, we are going to investigate the influence of the expanded waste glass material on vegetation activity in terms of its water relation capacity and permeability.

### Reference

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