Near Infrared Spectroscopic Analysis of Natural Circumstance Materials and Its Application

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1. INTRODUCTION

A night vision device is designed to detect and distinguish a target object easily when it is difficult to see things with the naked eye at nighttime. Detecting individual objects depends on reflectance value of materials at near-infrared ray[1]. Reflectance value represents of grey scale with a night vision device and it can detect invisible objects[2]. Therefore, when observing two different objects with the same color, we can discriminate two objects by the aid of the night vision device if the materials have different reflectance values at near-infrared ray. Such night vision devices are utilized for camouflage textiles. Since camouflage textiles are made for the purpose of disguising under natural environment, the data base of reflectance value on the surrounding natural environment has become crucial to manufacturing camouflage textiles[3].

In this study, consultation was sought to the "Institute for Forest Studies" about natural environment in Korea and natural environment samples which are the most profusely available in Korea were selected. For the selected samples, its reflectance values were characterized from visible ray to near-infrared (1050nm) ray. The analyzed reflectance values were subsequently classified into groups according to reflectance level, and the application of camouflage textiles was reviewed.

2. EXPERIMENTAL

2. 1. Materials

The 23 kinds of natural environment samples which are most abundant in Korea were selected. The samples were collected at Mt. Bukhan and Mt. Gwanak in March and July, 2008. The bark samples were mainly picked from pine trees and oak trees, classified into light, medium, and deep colors. The leaves were mainly collected from pine tree, white oak, Korean white pine, yew, false acacia, mulberry tree, and maple. The samples of stones and rock were gathered from basalt, gneiss, mudstone, sandstone, quartzite, marble, conglomerate, limestone, granite, asphalt, and cement. Soil and sand also were chosen as representative samples.

2. 2. Analysis of reflectance value

Using a Micro flash MF 45 IR(Datacolor), reflectance values of near-infrared ray in 700-1050nm were measured, and that was calibrated by using barium sulfate tile. For sample with irregular surface (like rock or bark) that involves the possibility of optical loss during measurement, the reflectance value of infrared was measured after grounding the sample into powder. In addition, five locations were set within the test pieces, and reflectance values were measured at the interval of 10nm.

3. RESULTS AND DISCUSSION

Fig. 1 showed near-infrared reflectance curve of natural environment samples in the hue of brown/khaki. The reflectance values of 25-70% were shown within the whole wavelength scope over 750nm. The materials in the color shade of brown/khaki under natural environment exhibited around the reflectance value of 45% within the region of near-infrared ray. As for tree barks, reflectance values were spread broadly in the range of 10-70%, and as the wavelength became longer, the reflectance value represented tendency of rising gradually. As for inorganic substance such as rock, sand, and soil, it showed uniform distribution of reflectance within the whole wavelength scope.

The oaks and the weeds of natural environment at Mt. Gwanak were displayed in night vision device and that shade of color confined to the shade of grey scale in Fig.2. When we took the picture, natural environment couldn't be observed with naked eye.

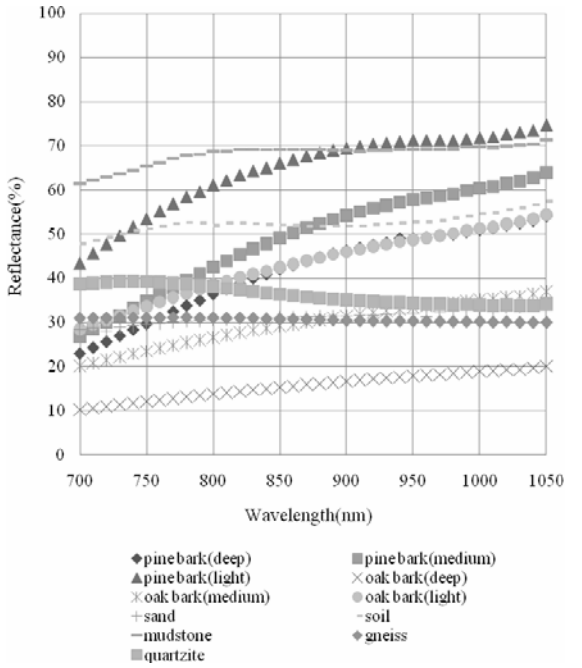

Fig. 1. Near-infrared spectra of natural environment samples in the color shade of brown/khaki.

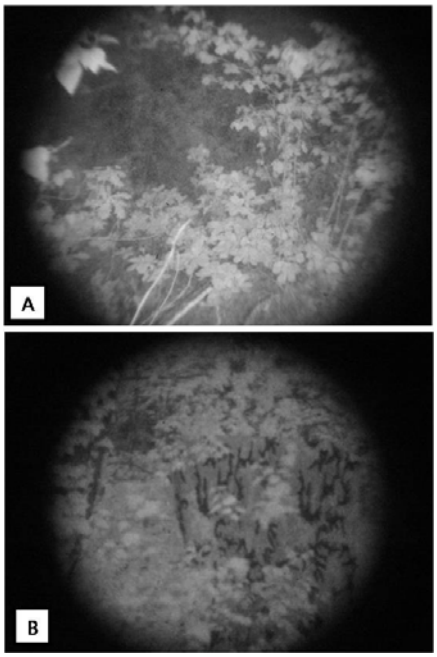

Fig. 2. The image of natural environment with night vision device(March at Mt. Gwanak). (A) The oaks and the weeds ; (B) Conventional camouflage textile in natural environment.

4. CONCLUSIONS

Reflectance values showed in broad scope as the kinds of natural environment samples, when observed with the night vision device, displayed reflectance values of infrared in the range of 25-80% and that samples were observed with diverse effects of brightness/darkness. Therefore, to bring about camouflage effect, reflectance of the 4 color patterns used for camouflage textile should be broadly distributed like those of natural environment samples.

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5. REFERENCE

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