

Development of Hybrid Mulching Sheets Using Tomato Stem and Rice Stalk

Shunhao Xu*, Xiulun Wang*, TingTing Wu* and Changqing Cai**

*Graduate School of Bioresources & Faculty of Bioresources, Mie University,
Tsu, Mie 514-8507, Japan
E-mail: 521d2s4@m.mie-u.ac.jp

**Changchun Institute of Technology, Changchun City 130012, China

Abstract

Natural fiber-based mulching sheets are biodegradable and pose no risk of microplastic pollution. While single-fiber mulching sheets have been developed in previous studies, this research proposed hybrid mulching sheets using tomato stem residues and rice stalks. The results confirmed the feasibility of combining natural fibers from different genera and families for mulching sheet production. The hybrid mulching sheets exhibited densities ranging from 0.684 g/cm³ to 0.792 g/cm³. The tensile rupture stress of the hybrid mulching sheets ranged from 9.78 MPa to 14.87 MPa. The light-shielding ratio of the mulching sheets was over 99.9%. The mulching sheets made from tomato stem residues showed particularly high tensile rupture stress. These results highlight a sustainable approach to utilizing diverse agricultural residues, providing potential alternatives to conventional plastic mulching films.

Key Words: Mulching sheets, Tomato stem, Rice stalk, Hybrid, Light-shielding ratio

1. Introduction

Mulching films are commonly used in agricultural production to create better growing conditions for crops. The application of agricultural mulching films effectively suppresses weed growth, maintains soil temperature, and reduces water evaporation. However, their use also raises environmental concerns. The most widely used material for producing mulching films is polyethylene (PE), which is very difficult to degrade in nature and might lead to serious plastic pollution in fields. Fragments of PE mulching films generated by UV radiation and aging may persist in the soil for decades, potentially entering the food chain and posing risks to human health. Due to their non-biodegradable nature, PE mulching films must be collected after use, a process that is both labor-intensive and time-consuming. The collected films are often contaminated with soil and