UNIVERSITÀ DEGLI STUDI DI SALERNO

Department of Industrial Engineering

Master’s degree in food engineering

Study of a biodegradable layer for silage covering

Thesis in

Transport Phenomena

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I dedicate this thesis to God for seeing me through this journey.

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Abstract

In this work new recipes for the preparation of biodegradable silage coatings were tested.

In particular, biofilms were prepared using cellulose, the silage itself and the sodium alginate.

The cellulose extraction method known as the Kraft process can be suggested for use while attempting to extract cellulose from sticks, even though the cellulose film that was initially intended to be used was unsuccessful despite following the instructions outlined in literature.

The film prepared using silage was found to be too sensitive to water. The film is also expensive and consumes large quantities of silage, which could instead be used as animal feed.

The alginate biofilm was therefore found to be the cheapest, easiest to make and with the best properties. To limit the shrinkage of the film due to the removal of water and to make it more palatable to animals, a filler was added to the film. Two kinds of fillers were chosen, a wood-based material "stick" and dried hay-based material "straw" with two different shapes, fiber and powder. To compare sodium alginate (SA) with and without filler content, which served as control sample, several tests were performed: shrinkage tests, mechanical tests (Young modulus, the elongation at break, tensile stress) and water absorption tests. The tensile test suggests that SA/Straw powder is the best in maintaining the pure biofilm alginate mechanical properties having a young modulus and breakage stress close to the control sample. However, such film showed a decrease of the strain at the breakage due to increase of stiffness. According to the water absorption test, the addition of fillers, both straw and stick in the shape of fiber and powder, decreased the relative humidity of the sample with respect to the control one.

From these results, it can be concluded that the SA/straw powder is the best possible filler or additive to incorporate in the alginate film for a better silage covering.

Chapter One

Introduction

In this chapter, there is an overview of the silage storage system and its coverings.

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