CORROSION CONTROL PACKAGING FILM PREPARED FROM A BIODEGRADABLE COMPOSTABLE RESIN

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ABSTRACT

Biodegradable packaging films that are useful in protecting metallic articles in corrosive atmospheres have been prepared and evaluated. The incorporation of volatile corrosion inhibitors in film-forming biodegradable polyester resins improves the corrosion resistance of the films to equal conventional polyethylene packages. These new films pass the recently approved ATSM standard and the proposed ECN standard for biodegradability and compostability and provide a "green alternative" to polyethylene.

INTRODUCTION

Corrosion is a plight that faces everyone who works with metals. Its impact on the United States economy has been documented to be about 4% of the Gross National Product. It was estimated that about one third of the corrosion damage could be avoided. The avoidable costs were related to the failure to use the best practices available.

There are several ways of combating corrosion. One way that is gaining wider acceptance is the one using vapor phase corrosion inhibitors.

Volatile corrosion inhibitors (VCIs) were originally developed to protect boilers and piping systems of ships to be mothballed. Their effectiveness and ease of application attracted early users. Over the years, the field of usage has increased to cover electronics, packaging, process industries, reinforced concrete, coatings, and metalworking fluids.

[new regulations]

EXPERIMENTAL

A polyester-based, poly (butylene) succinate, polymer was used as carrier for the

biodegradable VCI film for this study. This polymer is stable in the atmosphere but biodegradable in compost, wet soil, fresh water, sea water and activated sludge.

Extrusion

Corrosion testing

There are several methods to measure the effectiveness of vapor phase corrosion inhibitors. One method that is used quite widely is the Vapor Inhibiting Ability (VIA) test method [24]. It was developed to rapidly assess the protection offered by VCI compounds. The tested products can be powders, liquids or packaging products such as papers or plastic films. In this test method, a visible change in the surface finish such as pitting or etching is considered as corrosion. Stain alone does not constitute corrosion.

Biodegradability/Compostability testing

Chronic toxicity

Chronic toxicity was evaluated by performing seven-day static, renewal chronic toxicity tests. These chronic toxicity tests were performed to identify whether exposure to the water extracts would potentially produce sub-lethal, long-term (chronic), adverse effects on aquatic organisms. A water extract was prepared following the procedures specified in ASTM D5151-91 (Standard Practice for Water Extraction of residual Solids from Degraded Plastics for Toxicity Testing). The test organisms were larval fathead minnows. The chronic screening toxicity tests wer performed in accordance with methods specified by Weber et al (1991). Chronic toxicity was determined to have occurred if the growth of test organisms in the extract exposure were significantly less than that of the control organisms.

DISCUSSION

Corrosion testing results

The results for the Vapor Inhibiting Ability test are shown in Table 4.

Sample	Results
Control	Fail
VCI A	Pass

Table 4
VIA Test Results

The control plug had heavy corrosion, while plugs placed in the presence of VCI A had no signs of corrosion. The test samples were run in triplicate.

Biodegradability/Compostability testing

Chronic testing
Mean percent survival of the larva fathead minnows exposed to control and extract solutions was 97.5 survival in the control exposure and in the 100% extract exposure. Mean dry weight of fish exposed to the control and leachate exposures equaled 0.47 mg/fish for the lab control and 0.44 mg/fish for the 100% exposure.
Based on these test results, the extract had no significant adverse effects on larval fathead minnows.

SUMMARY

A new generation of VCI film has been developed to address the disposal concerns that some of the polyethylene VCI films have. Corrosion and biodegradation testing demonstrated that these new films not only provide excellent corrosion protection, but also readily degrade when placed in composting conditions. Chronic toxicity testing also showed that these films are not detrimental effect to aquatic organisms.

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