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Bio-catalysed polymerization of Lignosulfonates - a green chemistry approach

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PURPOSE OF THE ABSTRACT

Lignosulfonates are the most abundant side product of sulphite pulping. Their main usage up to now is energy and heat production by incineration and subsequent chemicals recovery. Moreover, those compounds are used as binders or dispersing agents. However, there is still strong need for novel processes towards value-added sustainable products out of lignosulfonates. This communication contributes to the laccase-based polymerization of lignosulfonates. Lignosulfonates are polymerised under oxidizing conditions. By controlling reaction time, polymer size can be adjusted1. With addition of reactive compounds such as phenols2, hydrophobicity is tuneable and polymer plasticity can be modified with plasticisers. With this adjusting coating of soil improvers and fertilisers is accessible.

In this study polymerised lignosulfonates were used as coatings for soil improvers granules. They were modified with glycerol and xylitol to achieve the desired plasticity of the coating of soil improver granules. Agriculture beneficial microorganisms (four different Bacillus species) were integrated into the coatings. The stable coatings protected the marine calcium carbonate granules, maintained the viability of the microorganisms and showed no toxic effects on the germination and growth of model plants including corn, wheat, salad, and tomato despite a slight delay in germination. Moreover, the coatings reduced the dust formation of soil improvers by 70%. CO2 emission analysis showed potential for the reduction of up to 3.4 kg CO2-eq. kg?1 product, making it a viable alternative to fossil-based coatings3.

By usage of these soil improvers in field trials in Austria, growth rate of lawn was enhanced, and product quality was improved.

FIGURES

FIGURE 1

FIGURE 2

KEYWORDS

Lignosulfonates | Polymerisation | Biocatalysis | greenhouse gas savings

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