SUMMARY

Studies on environmentally friendly flame retardants for cellulosebased materials - Continuation

Flame retardants are commonly used as a way to reduce the risk of fire. However, many of the currently used flame retardants are toxic and hazardous for the environment. Therefore, there are incentives to find safer alternatives. In nature, there are many substances that can function as non-toxic and environmentally friendly flame retardants. Phytic acid is the main storage form of phosphorus in plants and can be found in e.g. nuts and cereals. Amino acids are the building blocks of enzymes and proteins. Many common metal ions are important nutrients.

Purpose and aim

This project is a continuation of an earlier Brandforsk project with the purpose of finding an environmentally friendly and non-toxic flame retardant for cellulose-based materials by mixing phytic acid and metal ions. The aim has been to utilize the knowledge gained from that project to improve the flame retarding properties by adding amino acids.

Methods

Systematic investigations have been performed on cotton pieces treated with various mixtures of phytic acid, amino acids, and metal ions. Combustion tests, thermal gravimetrical analyses (TGA), and cone calorimetry tests were combined to find the best combination of ingredients for optimal flame retardant properties. MAS NMR analyses were used to describe what is happening with the flame retardant at different temperatures and could be correlated to the results from the thermal analyses. Leaching tests were performed to determine the amount of phytic acid and amino acid dissolved from the flame retardant coating in contact with water.

Results

All tested combinations of ingredients have flame retarding ability and lead to self-extinguishment. The amount of sodium ions relative to phytic acid affects the charring ability. The addition of amino acids improves the flame retardant efficiency compared to having only sodium ions. Arginine was the amino acid which showed the best result because it can theoretically produce the largest amount of non-combustible gases per molecule. However, the amount of amino acid relative to phytic acid is important. The addition of multivalent metal ions reduces the flame retarding ability a little compared to samples with only sodium ions and amino acids, but the solubility decreases considerably

RESEARCH TEAM

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