Controlling the release of wood extractives into water bodies by selecting suitable eucalyptus species

Abstract

Pulping industries are increasing worldwide as a result of the increase in the demand for pulp for cellulose derivatives and paper manufacturing. Due to the activities involved in pulping processes, different chemicals from raw materials (wood) and bleaching agents are released in pulp-mill effluent streams discharged into the environment and find their way into water bodies. Large quantities of water and chemicals used in pulping result in large amounts of wastewater with high concentrations of extractives such as unsaturated fatty acids, which are known to be toxic, and plant sterols which affect the development, growth and reproduction of aquatic organisms. This study was aimed at assessing the composition of extractives in two eucalyptus species used for pulp production in South Africa, in order to identify the suitable species with regard to extractive content. Samples from two eucalyptus plant species (*Eucalyptus grandis* and *Eucalyptus dunnii*) were collected from three sites and analysed for extractives by first extracting with water, followed by Soxhlet extraction using acetone. Compounds were identified and quantified using gas chromatography-mass spectrometry (GC-MS). Major classes of extractives identified were fatty acids (mainly hexadecanoic acid, 9,12-octadecadienoic, 9-octadecenoic and octadecanoic acids) and sterols (mainly β-sitosterol and stigmastanol). *E. dunnii* was found to contain higher amounts of the compounds compared to those found in *E. grandis* in all sampled sites. Principal component analysis (PCA) was performed and explained 92.9% of the total variation using three principal components. It was revealed that the percentage of fatty acids, which has a negative influence on both principal components 2 and 3, was responsible for the difference between the species. *E. grandis*, which was found to contain low amounts of extractives, was therefore found suitable for pulping with regard to minimal water usage and environment pollution.

Keywords

- Eucalyptus species;
- Gas chromatography mass spectrometry;
- Principal component analysis;
- Wood extractives