

ABSTRACT

The main aim of this research was to explore possibilities to address the utilisation of the vast amounts of banana waste through extraction of phenolic compounds due to their potential functional properties as well as investigate the possibility of diversifying banana starch applications by testing its application as a wall material in the encapsulation of the extracted phenolic compounds. Five cultivars of the East African Highland Banana (*Musa acuminate* AAA- EA) were selected for this study. Characterisation of starch from these banana cultivars was done and result showed that the compositional, granular and molecular characteristics of all the cultivars in the study did not differ significantly.

The modification of banana starch in this study involved use of chemical (HCl) and physical (heat) means to produce modified banana starch. The results suggested that banana starch has quality attributes that could give it a place in the commercial starch industry, both as native starch and as modified starch.

Methanol, ethanol, acetone at varying proportions with water were used to determine their extraction efficiency with regards to the banana polyphenols in roasting bananas plantain type (*Musa acuminata*) AAB genotype) known locally as Gonja and the cooking/ juice type bananas (*Musa acuminata*) ABB genotype known locally as Kivuvu. The examination of the efficiency of different solvent systems for the extraction of the banana polyphenols as well as determination of the total polyphenolic content, phenolic compounds and antioxidant capacity of the roasting bananas plantain type (*Musa acuminata*) AAB genotype) known locally as Gonja and the cooking/ juice type bananas (*Musa acuminata*) ABB genotype known locally as Kivuvu. The results showed that generally the bananas under study had a high antioxidant activity irrespective of their maturity and plant part. Determination of the polyphenolic profile of the mature Gonja peel, mature Kivuvu peel and young Kivuvu pulp and peel using HPLC-DAD-ESI/MS analysis showed a high variability of polyphenols in the samples. Mature gonja (AAB) peel had a high number of polyphenolic compounds identified.

In this work, microencapsulation of banana polyphenols was successfully performed using the frequently used wall material for encapsulation (maltodextrin) as well as a novel material (modified banana starch) that had never been used for encapsulation before. Further, the banana polyphenols according to the available literature had also never been microencapsulated.

The efficiency of the production of the banana phenolics powder was characterized by product recoveries higher than 50% for certain experimental conditions (10% maltodextrin at 160, 180, 200 °C inlet temperature or 5% modified banana starch at 160 °C inlet temperature). The banana phenolics powder extracts obtained from modified banana starch of 5% gave comparable results to 10% maltodextrin in terms of yield, TPC and antioxidant activity.

Keywords: Banana starch, East African Highland Banana (EAHB), phenolic compounds, Total Phenolic Content (TPC), antioxidant activity, microencapsulation