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Short Communication

Alkyd Resin from *Ipomoea batatas* Lam.

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Abstract. A new alkyd resin has been isolated from the hexane extract of powdered sweet potato (*Ipomoea batatas* Lam.) peels. The proposed structure of the compound was established to be Poly 3-(2,4-dihydroxyphenyl) butanoate by means of data obtained from the FTIR, ^{1}H-NMR and ^{13}C-NMR spectra.

Keywords: *Ipomoea batatas*, Poly 3-(2,4-dihydroxyphenyl) butanoate, alkyd resin, renewable resin

Sweet potato (*Ipomoea batatas* Lam.) is a member of the Convolvulaceae family which originated from south Mexico and Central America. It is considered to be the seventh most important crop worldwide (Woolfe, 1992). It is a cheap and readily available staple food in Nigeria, with promising nutritional attributes rich in vitamin B_6, vitamin C, manganese, copper, potassium and iron (Antia *et al*., 2006). The colour of the flesh of the root vegetable ranges from white to yellow, orange, red or purple depending on the variety (Wood and Young, 1974). Leaves are rich in protein, minerals and vitamins (Ishida *et al*., 2000).

Antioxidant activity of sweet potato peel is due to the presence of phenolic acids (Oyeneho and Hettiardichy, 1993). Furthermore, sweet potato peel extracts possess great antioxidant potency (Rajini and Nandita, 2004) and have been ultilised as natural antioxidants in soybean oil and can be used safely instead of synthetic antioxidants (Zia-ur-Rahman *et al*., 2004). Potato peel also has some medicinal applications as studied by Majorie (2000); Subrahmanyam (1996) and Aakanksha and Keswani (1985). Although Oyeneho and Hettiarachchy (1993) had found some polyphenolic compounds in potato peels, no such work has been reported on sweet potato peels in our environment.

Fatty acids with potential for conversion to alkyd resins have been obtained from various plants as reported by Emelugo *et al*. (2011); Ogunniyi and Odetoye (2008); Banerjee (2005) and Akintayo (2004). Alkyd resin plays an important role in the paint, coating and surfactant industries. Soya bean oil is used as a source of alkyd resin with good success (Kharkate *et al*., 2005) and more renewable sources need to be sorted. Since there is constant demand for biodegradable polymeric resin for both food and non-food products, presence of an alkyd resin from *Ipomoea batatas* has been investigated. The aim of this work therefore, was to isolate and determine the chemical constituents of sweet potato peels to promote its new uses.

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Twenty tubers of white skinned variety of sweet potato (*I. batatas* Lam.) were obtained from a local market in Ilorin, Nigeria and identified by a taxonomist at the herbarium of Biological Department of the University of Ilorin, Ilorin, Nigeria. The peels were carefully removed, air-dried at room temperature and stored in a cool dark place until further analysis. The peels unavoidably contained minute sweet potato tissues.

Extraction. The peel (221 g) was dried, pulverized and extracted with hexane using Soxhlet extractor for 6 h. The extract was concentrated *in vacuo* to yield (8.6 g) thick blackish syrup.

Thin layer chromatography (TLC). The TLC was carried out on a precoated aluminium plates (Silica gel G_{F254}, 0.25 mm Merck W. Germany). Spots were detected under ultraviolet/visible light (254 and 366 nm) before spraying with vanillin spray reagent followed by heating the plate at 110 °C for about 5 min.

Column chromatography. The crude extract was fractionated using silica gel column chromatography (column diameter 4.2 cm, height 35 cm) into its chemical constituents using a solvent system: hexane/diethyl ether; 2:1. Thirty six fractions were obtained. The column chromatography (CC) was monitored with TLC and the fractions were combined as appropriate. Combined fractions 4-12 afforded the alkyd resin, which was further subjected to PTLC.

Preparative TLC (Prep. TLC**).** This was performed on a pre-coated silica gel glass plates (20 × 20 cm) in order to isolate the target compound from the CC fractions 4-12. The alkyd resin (0.6 g) (Fig. 1) with R_f 0.77, hexane: diethyl ether; 2:1 was thus isolated and subjected to FTIR and NMR spectroscopic analyses.

Infrared spectroscopy. The infrared spectrum was recorded on a Shimadzu Fourier Transform Infrared Spectrocopy (FTIR) spectrophotometer using KBr pellet.

NMR spectroscopy. ^{1}H and ^{13}C NMR spectra were recorded on NMR (Mercury 200 BB) instrument operating at a frequency of 200 MHz.

The infrared spectroscopic analysis of the compound shows absorption bands at 3440.66cm^{-1} br (O-H str), 3008 cm^{-1}(aromatic C-H str), 956.12 cm^{-1}, 2925.28 cm^{-1} (aliphatic C-H str), 1735.90 cm^{-1} (C=O of an ester), 1639.42 cm^{-1} (C=C str), 1274 cm^{-1}, 1074 cm^{-1} (C-O str of an ester). The ^{1}H-NMR spectrum showed signal at δ_H 0.9 ppm (methyl protons), δ_H 1.3-1.6 ppm (R-CH_2), δ_H 2-2.2 ppm (-CH-COOR), δ_H 2.3-2.4 ppm (Benzylic proton), δ_H 2.8 ppm (H-C-C=O), δ_H 4.2-4.5 ppm (phenolic proton), δ_H 5.4 ppm (vinyllic proton) and δ_H 7.5-7.8 ppm (aromatic protons). The ^{13}C-NMR of the compound had δ_C 17-34 ppm (CH_3CH_2), δ_C 60-70 ppm (C-O), δ_C 130 ppm (C=C), δ_C 168-176 ppm (C=O of an ester).

Hence the proposed compound which accounted for about 7% of the extract is named Poly 3-(2,4-dihydroxy-phenyl) butanoate (Fig. 1).

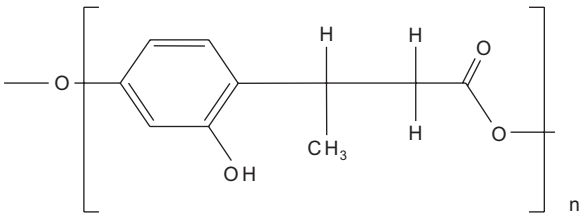

Fig. 1. Poly 3-(2, 4-dihydroxyphenyl) butanoate.

Further investigations shall determine how this alkyd resin can be incorporated into presently available materials for the paint and coating industries. The incorporation of a plant-based alkyd resin into polymeric surfactant (detergent) and paint will assist in making products that are biodegradable and ecofriendly. The result suggests that sweet potato peel could be a natural renewable and valuable source of biodegradable eco-friendly alkyd resin with potentials for future exploration.

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