EMPIRICAL MODELING OF THIN LAYER DRYING CHARACTERISTICS OF *NAUCLEA LATIFOLIA* LEAVES

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ABSTRACT

The thin layer drying characteristics of Nauclea latifolia leaves were studied at four drying temperatures of 35, 45, 55 and 65°C and a constant air velocity of 1.5 m/s in a convective dryer. Experimental kinetic data were fitted to four established drying models available in the literature, namely: the Newton, Henderson and Pabis, Page and Logarithmic models. Model parameters were determined by using non-linear regression analysis while the goodness of fit was assessed by the coefficient of determination (R^2), root mean square error (RMSE) and the standard error (SE). Fick's diffusion model and Arrhenius-type equation were used to determine the effective diffusivity and activation energy, respectively. The increase in air temperature significantly reduced the drying time of the Nauclea latifolia leaves. Among the models proposed, the Page model was found satisfactory for describing the air-drying kinetics of Nauclea latifolia leaves. The effective diffusivity increases as temperature increases and ranged between 3.3841 E-08 - 1.1202 E-07 m^2/s while the activation energy of diffusion was estimated to be 40.55 kJ/mol.

***Keywords:** Nauclea latifolia leaves, Convective drying, Modeling, Activation energy, Moisture diffusivity.*

1. INTRODUCTION

Nauclea latifolia, a member of plant family Rubiaceae, is known to be of high medicinal value (Deeni and Hussain, 1991). *Nauclea latifolia* often known as African peach or pin cushion tree is a straggling evergreen, multi-stemmed shrub or small tree native to tropical Africa and Asia. The leaves, stems, roots and fruits of *Nauclea latifolia* are of high, significant medicinal importance. The extracts of *Nauclea latifolia* have been reported to be potent against bacterial (Okwori *et al.*, 2008; Doughari, 2008), viral (Donalisio *et al.*, 2013), diabetic (Gidado and Ameh, 2005), and plasmodia (Benoit-Vical *et al.*, 1998) activities. The phytochemicals found in *Nauclea latifolia* are indole alkaloids, triterpenes, steroids and saponins (Donalisio *et al.*, 2013). Traditional use of the various parts of the plant include the treatment of jaundice, yellow fever, rheumatism, abdominal pains, loss of appetite, malaria, diarrhea, dysentery, hypertension, diabetes and hepatitis (Donalisio *et al.*, 2013). Ayeleso *et al.* (2014) also reported that *Nauclea latifolia* has strong antioxidant potentials with the leaves demonstrating higher *in vitro* antioxidant activities than the fruits. The leaves were found to contain polyphenols, flavanol, and flavonol which further encourage the use of the leaves of *Nauclea latifolia*. The high moisture content of the leaves however, makes it perishable and significantly affects its shelf life and quality. To preserve the quality (including bio-activities) of the leaves for effective utilization at any time and enhanced shelf-life, postharvest processing aspect is very important (Rayaguru and Routray, 2011). One of the oldest and most widely employed technologies to avoid spoilage and improve shelf life is drying.

Drying is a method of reduction of water activity values through moisture removal to achieve physicochemical and microbiological stability (Nag and Dash, 2016). Drying removes moisture through simultaneous heat and mass transfer and it provides longer shelf life, lighter weight for transportation and smaller space for storage (Karimi *et al.*, 2012). However, drying is not only affecting the water content of the product, but also alters other physical, biological and chemical properties such as aroma, bioactivity, colour, antioxidant activities as well as palatability of foods (Rayaguru and Routray, 2011; Wojdylo *et al.*, 2009). Therefore, appropriately controlled drying of the leaves appears to be the only means of preserving the quality of the leaves. Hence standardization of drying operation specific to leaves of *Nauclea latifolia* is a necessity in order to achieve the simultaneous purpose of quality preservation and

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