OPTIMUM DEHYDRATION AND DRYING KINETICS OF THREE SELECTED VARIETIES OF TOMATO (*Lycopersicum species*) FROM SOUTHWESTERN NIGERIA.

BY

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DEDICATION

This research work is dedicated to

“THE STRENGTH OF ISREAL”

And

To the sweet memories of my father in the Lord **Pastor (DR) Micheal Adebola JEGEDE**

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To the king eternal, immortal, invisible the only God, be honour and glory forever.

CERTIFICATION

I certify that this work was carried out by **JAIYEOBA,** Kehinde Folake in the Department of Agricultural and Environmental Engineering, Faculty of Technology, University of Ibadan, Ibadan, Nigeria.

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ABSTRACT

Tomato (*Lycoperscium spp.*) is an important component of daily dietary intake with seasonal and geographical variation in its production. They are usually in short supply in the dry season and effective storage in the fresh state still poses a challenge. Pre-treatment methods have been reported to improve drying characteristics of fruits and vegetables but there is dearth of information on drying of indigenous variety of tomato despite its high nutritional value. Pre-treatment methods for three varieties of tomato from southwestern Nigeria and drying conditions with mass transfer kinetics for the optimally pre-treated variety were investigated.

Roma-VF (*Lycopersicum esculentum* Mill), Koledowo (*Lycopersicum pimpinellifolium Mill*) and Ibadan-Local (*Lycopersicum esculentum CV)* were used in this study. Samples were pre-treated in binary osmotic solutions (sugar and salt) at different concentrations (40/20, 45/15, 50/10^{o}Brix/%), temperature (30, 40, 50^{o}C) and time (30, 60, 90, 120, 180min) using fruit to solution ratio 1:10. Moisture Content (MC) was determined using the AOAC standard. Models for water loss (W_L), solid gain (S_G) and weight reduction (W_R) were developed and optimal response (highest W_L, W_R, least S_G and MC) was obtained and data were analyzed using ANOVA at p=0.05 within and across varieties. Mechanism of mass transfer phenomena was studied by drying at 40, 50 and 60^{o}C. Five thin layer drying models (Exponential, Henderson and Pabis, Page, Modified Page and Logarithmic) were compared and fitted into the experimental moisture ratio. Adequacy of fit was based on highest R^2, χ^2 and least RMSE. Diffusion coefficient and activation energy were determined using Arrhenius equation.

Water loss increased with increasing solution temperature and sugar/salt concentration. Ibadan-Local and Roma varieties had their highest W_L (0.30) at 45/15 sugar/salt concentration, while Koledowo had its highest W_L (0.26) at 40/20 sugar/salt concentration all at 50^{o}C solution and 50^{o}C drying temperatures which could possibly be due to its thicker outer skin impeding moisture migration. Water loss and S_G were significantly different among the varieties. As temperature increased from 40-50^{o}C, drying time reduced from 26-18.5 h (treated) and 35-25.5 h (untreated) respectively in Ibadan-Local variety. Drying occurred in falling rate period with better curves in pre-osmosized tomato. Exponential model fitted at 40^{o}C with R^2, χ^2 and RMSE ranges of

0.83-0.90, 199.37-380.02 and 0.0797-0.1009, at 45^{o}C 0.94-0.98, 735.49-2706.82 and 0.0464-0.3640 and at 50^{o}C, Henderson and Pabis fitted at 0.85-0.90, 187.87-380.02 and 0.0798-0.0966 respectively for treated tomato. For untreated tomato at 40^{o}C, Page model fitted with R^2, χ^2 and RMSE ranges of 0.95-0.98, 881.61-2938.62 and 0.0301-0.0538, Page and Modified Page at 45^{o}C with 0.92-0.08, 246.71-607.28 and 0.0798-0.0966 and Modified Page fitted at 50^{o}C with 0.83-0.92, 246.99-607.24 and 0.0778-0.1008 respectively. Moisture diffusivity was higher in pre-treated in Ibadan-Local samples ranging from 1.17-3.51x10^{-8} compared to untreated with 1.25-3.13x10^{-8} while the activation energies were respectively 46.81 kJ/mol and 52.61 kJ/mol implying faster drying with lower energy requirement in osmosized sample.

Optimum pre-treatment conditions have been established for the three varieties of tomato. Effective moisture diffusivity and activation energy of pre-treated Ibadan-Local were within the range for most agricultural materials. Faster drying and lower energy requirement make osmosized pre-treatment a promising approach for drying of Ibadan-Local variety.

Keywords Tomato, Osmotic dehydration, Drying kinetics, Effective moisture diffusivity, Activation energy

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